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EDITORIAL NOTES—GAS, &c.

A Large Field for Business.

POINT out the part of the ordinary domestic gas business in which the least amount of custom exists, and there you have the part of the business which requires the exercise of special energy to develop it. That part of the business is not the lighting; it is certainly not the cooking; and the prepayment branch is expanding at rapid pace. The portion of the domestic business that is the least developed is therefore that of heating; and, as suggested in the editorial columns last week, the time now seems to be exceptionally opportune for working up this business to its utmost. For heating, coal holds greatest favour among householders, and not on account of labour-saving, of cleanliness, of handiness, or of economy when the fact is remembered that there is great waste in a coal fire, owing to the necessity of maintenance merely for intermittent use. Coal, too, is dear at the moment. Throughout the country, there are people who are asking for a smokeless fuel. "Coalite," "Carbo," and similar varieties are already on offer, and no substantial gas undertaking will say "Nay" to a good demand for partially carbonized coal—at a price. But all these solid fuels suffer from want of handiness; their use imposes conveyance to and about a house, and frequent attention, though less dirt is yielded by them than by coal. Electricity has tried, by devious devices, to make its way in the heating field; but its success has not been striking—expense and low efficiency being deterrents in progress. It would therefore appear from such considerations as these, that the present is, as we have put it, an opportune time to see whether something out of the ordinary groove cannot be done to give a fillip to the domestic gas-heating business. We do not intend to suggest that there is any lack of commercial enterprise among the major part of the gas undertakings of the country; but what we do suggest is that the time is an especially favourable one to turn more of that enterprise on to the weakest and much neglected part of the gas business, and try to establish it on a more popular foundation.

Sanitarians have long been crying aloud for something to be done to turn to a more refined state the miasmatic atmospheres of our cities and towns; but local authorities nod their approbation, bestir themselves a little over the emanations of the factory chimney, but give scant or no thought to the great mischief wrought by the accumulated emissions of the domestic chimney. They levy rates, for sanitary, protective, and improvement purposes. Large sums are spent, in the name of improvement, in putting up fine buildings, and in the bettering of surfaces and spaces; and the process of deterioration commences at once by the much neglected atmosphere. Here is one of the contrarieties of our municipal life. All constructed things on the earth and under the surface of the earth in the municipal area are expected to come, in some form or other, under the care of the local authorities; but they pay little heed—and that little heed bears largely a perfunctory character—to those things that are not so perceptible as fine buildings, surfaces, and areas, but which occasion incessantly an immense amount of corruption. We know well, and they know, but they do not move in the matter (though the London County Council have threatened to do so failing voluntary improvement on the part of the householder), that their statutory powers are limited in the matter of smoke prevention. But we say, and say emphatically, that municipalities do not accomplish all that they might in this matter. There are no less than 270 statutory municipal gas undertakings in this country; but observation has not created in us any spark of admiration for their special efforts in stimulating the use of the products of the gas-works for heating purposes, with the view of producing one of the greatest sanitary benefits that can be conferred on any community. If these municipal authorities owning gas-works would only lead in this matter, any success that resulted could be used to attract the notice of those municipal authorities in cities and towns served by companies; and between such municipal authorities and companies there is no insurmountable reason why there should not be co-operative work in such improvement. It is not a business in which there can be compulsion, but it is a business in which—given efficient heating-stoves—example and encouraging terms would do much to accelerate the progress of adoption by the householder of heating by gaseous fuel. While we are writing thus, it is a matter of interest to note that the Corporation of Manchester and other surrounding local authorities are taking a keen interest in the forthcoming Manchester Gas Exhibition—a considerable section of which will be devoted to the purpose of demonstrating the advances made in domestic heating by gas.

The gas industry has a large business, and it has kept itself abreast of the demands upon it. But large as this business is, there is every cause why the industry should do more and have more. Many years ago, the learned and presbytic Siemens declared that this country would not be free from smoke until the whole of its fuel was of the gaseous form; and other men of light and leading have asserted that the gas-works ought to be not only the great centre from which the means of lighting is supplied, but the centre from which the means of heating is also distributed by the existing subterranean canalization. We do not think there is full appreciation of the immensity of the field offered by domestic heating. It is calculated that the consumption of coal for domestic purposes—omitting manufacturing use altogether—is equal to 1¼ tons a year per head of the population. The estimated population of the United Kingdom in 1906 was 43,660,000; and multiplying this by 1¼ tons, we have an aggregate consumption of coal in the United Kingdom for domestic purposes of 54,575,000 tons. This quantity of coal carbonized at the gas-works would produce, calculating an average make of (say) 10,500 cubic feet of gas per ton, 573,037,500,000 cubic feet of gas. The statutory gas undertakings of the United Kingdom, according to the last issued returns, sold 161,407,725,000 cubic feet of gas in the year. Compare these two groups of figures; and the former will be found to be 3·55 times larger than the latter. It is not forgotten that part of the 1¼ tons of coal per head still used is employed for cooking purposes in the summer; but the proportion consumed for cooking compared with that used for heating is a diminishing quantity through the popularity of the gas-cooker. But what do these figures mean? The answer is, that the universal deposing of the coal grate and range by the gas fire and the cooker in the United Kingdom would produce an expansion of the present volume of the business of the gas industry by between three and four times, and the removal from our atmosphere of a large amount of its unwholesomeness and banefulness. The gas industry would benefit, the community would benefit both in health and in the savings to be effected by the removal of the injury wrought by the smoke-laden atmosphere, and the consumer would benefit; for has Professor Vivian B. Lewes not said that, for heating, gas at 2s. per 1000 cubic feet is equal in value to the consumer to coal at 18s. per ton? Inasmuch as household coals are being quoted at much higher prices—the best in London at 28s. and 29s. per ton—there is a good margin to work upon, and where the prices of heating gas are in the region of Professor Lewes's 2s., there is economy for the consumer, which is increased by the collateral advantages of its immediate lighting and extinguishing (thus saving the expense of maintenance for only intermittent use), and the almost complete abolition of labour.

It has been remarked, in the earlier part of this article, that the heating business (the possibilities of which are so considerable), if it is to be obtained, must be encouraged; and encouragement undoubtedly means differential prices for lighting and heating. The manufacturers of gas-fires have done

something (though they have not attained the zenith of their hopes) in producing a very essential economy by reducing the consumption and increasing the efficiency of their fires, but what has the gas maker done towards encouraging the business? In most cases, absolutely nothing; and therefore we do think that the subject is worth discussing, particularly at the present time. We know it will be advanced that the time, with high prices ruling for coal, is a wrong one to talk about differential prices for gas. We are not prepared to admit that. It is just the time when, among householders, arguments will go home with more effect than when the prices of solid fuel are low; and we do know this that as the gas business expands so the capital and other charges (when the management has been on judicious lines) do diminish. The use of gas for heating purposes will tend to largely fill the valleys in the output curves, so helping to equalize output without in any really appreciable measure causing addition to the capital expenditure, establishment charges, management, and so forth. The bigger the business of this class, the more attenuated become the outgoings per 1000 cubic feet, and the lower the rate at which profitable business can be done. Of course, the heating business comes when the lighting business is heavy; but the lighting business does not proceed in any great measure during the hours of daylight. That there is business to be done in heating in addition to that already secured, is obvious from what electricians are doing. By push they can get heating business, with inefficient radiators, at 1d., 1½d., and even 2d. per unit of electricity. For instance, in the small area known as the City of London, one of the two Electric Lighting Companies supplying there had as many as 2000 four-lamp radiators linked up to their cables at the end of last winter; and these increased the rate of output on cold days by as much as 500 kilowatts—the charge being 1½d. per unit; and that is dear when the poor efficiency of the radiator is considered. The electrician, however, has found out that the collateral advantages are not of strength sufficient to obtain neating business. The consumer wants something else, and something that will appeal to his pocket. Hence differential prices. The differential price does not present the same difficulty in its application to gas supply that it did a few years since, of necessitating an expensive duplication of meters and piping. A small meter that will register approximately the proportion of gas consumed by each gas-fire is all that is required; and every gas manager knows of such on the market.

Here is the field. If gaseous fuel is to occupy it, it must be competed for in that liberal, commercial spirit that has swept before it the trade of the world. The straight, hidebound policy of monopoly will not do. Against gas there is competition in every field; and sound competitive tactics must obtain. If any of our readers have aught to say on this subject, we shall be glad to hear from them.

The Companies' Bill.

One of the last acts of the House of Commons before the prorogation was the final passing of the Companies' Bill. In numerous small details, the measure as Royal Assented differs from the original; but in its leading features, it remains the same. It is only a deserved compliment to say, although a measure of the kind cannot meet with the approval of all, that to the President of the Board of Trade is due the utmost praise for piloting through such a measure, affecting, as it does, so many sensitive interests. Mr. Lloyd-George took counsel with many men of repute in company law and finance; and the outcome is an Act which, speaking generally, gives much satisfaction. The hypercritical complain that the Act is but another instance of how company legislation in this country always appears to proceed on the lines that only the seamy side is known to the Government, with the result that wholesome enterprise is much and unjustly confined. This is plausible argument; but it will not bear analysis. To a degree it is, of course, true. But so long as malfeasance exists, the need is proved for correction and control; and, if rectifying legislation can be produced, it protects straightforward conduct from the stigma or malign influence of wrong-doing, and the tendency is to sustain confidence. In this way, honest and circumspect joint-stock enterprise gains. There is no direction in which protecting and regulating legislation is so necessary as in connection with the promotion and financial administration of companies to the custody of which the public commits large sums of money.

The measure was founded on the recommendations of the Departmental Committee appointed in 1905 by the Board of Trade; and the principle underlying it (as stated in the King's Speech at the close of the session) is the affording of fuller information to all who may seek for it concerning the Companies registered under the Companies' Acts, and to give a greater degree of protection to creditors, shareholders, and the public generally. In the first place, people are too prone to judge the character of a concern by the character of members of the directorate. A greater mistake could not be made. Men whose probity is above reproach sometimes fall victims to machinations of rascals who live and enrich themselves on the gullibility of others; and who are awake to the fact that the adorning of prospectuses with reputable names serves the object of entrapping public money. The Act aims at fraudulent prospectuses and the protection of innocent investors. The requirements of the Act of 1900 are enlarged; and any prospectus henceforth issued must disclose with fulness any material facts which would be calculated to influence the minds of intending investors. It will go hard with promotors against whom the charge can be sustained that they have neglected in their prospectuses to divulge material facts which might have influenced investors. To our regret, there have been a fair number of instances of obliquity in this regard in company promoting in the gas industry during the past two or three years; and the more strengthening of legislation there is, the better, if only it is effectual in killing these rank growths. To avoid disclosure, there have been promoters who have sold shares direct on the Stock Exchange, without issuing a prospectus. But such as these must now lodge a full statement of facts with the Registrar at Somerset House, where inspection can be made. The provisions of the Companies' Act of 1900 are also enlarged by making it necessary to register all mortgages and charges with the Registrar of Joint-Stock Companies, including those relating to landed property and book debts. Other clauses will remove doubts as to the validity of perpetual debentures and debenture stock, and enable a company to keep alive and reissue debentures which have been redeemed. Another section requires every company to file annually with the Registrar a statement of their affairs in the form of a balance-sheet. It is to contain a summary of its capital liabilities and assets; but it need not embrace a statement of profit and loss. Although this provision is new to English law, similar provision has since 1888 been part of the Indian law relating to companies, and since 1896 has formed part of the law of the Colony of Victoria. There is therefore precedent as to its beneficial working.

A useful provision is one passed in accordance with the recommendations of the Royal Commission, allowing, under conditions specified in the Act, companies to pay interest out of capital on shares issued for the purpose of raising money to defray the expenses of the construction of any works, buildings, or plant, which cannot be made profitable for a lengthened period. In Committee, an abortive attempt was made to restrict this provision to works of a "permanent" character, on the ground that some companies might make an improper use of the power; but we think ample safeguards are provided by, among others, the restrictions that no such payment is to be made unless authorized by the Articles of Association, or by special resolution of the Company, and, in any event, the Board of Trade are to have a voice in the matter and powers of inquiry and regulation. As Mr. Lloyd-George says, if investors are to be induced to put their money into works in this country, the area of investment must be made as wide and inviting as possible; and this provision will therefore be very valuable. In the measure as it originally stood, there was power to companies to issue shares at a discount, but that has been deleted. Though the disability operates hardly in cases where shares and stocks stand in the market at a little below par, on the whole it is better the limitation should not be relaxed. The scope of City tricksters does not want extending; and we can well see how such a power might work to the injury of company and investors, on the escape of knowledge of a prospective issue, by the depressing of the particular stock or shares below par. The difficulties in the paths of gambling and mischievous conduct, which ruin on the one hand and enrich the prime movers on the other, do not need removal; and therefore, at the instance of the President of the Board of Trade, the clause was expunged, and an endeavour to replace it was frustrated.

When in Committee, there was great discussion around a clause proposing to give power to a Court of Law to grant

relief to Directors in cases where a breach of duty had been caused by honest oversight, inadvertence, or error of judgment. The debate indicated how much there is to be said on both sides of the question. Directors after all are only human; and they are as prone to err as other people. Honest oversight, inadvertence, and errors of judgment are venial offences; and in such cases the utmost consideration and sympathy can be shown in our Law Courts. Mr. Justice Buckley has stated that in no case has a director been held responsible for an innocent mistake; and Lord Halsbury has placed among his dicta that a director could not be held liable unless he could be charged with some sort of moral obliquity. From this it is plain the specific provision for relief was really unnecessary; and it is to be hoped that the express power to the Courts will not loosen the strings about the incompetents and the wilfully negligent, nor afford a loophole for the escape of any from the penalty of their treachery to the confidence reposed in them.

Among other sections, it is noticed that the wrongful use of the word "Limited" in the titles of public companies will in future be visited with a heavy penalty. The Act also tightens the hold over Companies established in this country and carrying on businesses in other countries. We cannot understand why the Board of Trade caused the removal from the measure of what was originally intended to be included in connection with the auditing of Companies' accounts. It was at first proposed that, in the case of every company whose authorized capital amounts to £50,000, one at least of the auditors should always be a person who professionally carries on the business of an accountant; and we do think that the excision of this provision is not in the best interests of public safety. All too often in the case of public companies men are appointed auditors who are no more fitted for the duty than the veriest tyro in business. A point which will give great satisfaction is the kindly attitude of the President of the Board of Trade to profit-sharing or copartnership. Mr. Theodore Taylor, well known in trade co-operative work, was the author of a provision for exemption, from a clause bearing on the number or the increase of the number of the members of a company, of any company which confines the transfer of its shares to persons in the service of the company. The provision was accepted in Committee by Mr. Lloyd-George with the remark that "it is very desirable this "kind of arrangement should be encouraged." "It has," he added, "worked very well in promoting good feeling be- "tween employer and workman; and it is a thing we ought "to do all in our power to help along." With this expression of opinion, there will be a widespread tacit consent, but will it incite to further action? However that may be, of the provisions of the new Act the Directors of every Company should have cognizance; but the details are too voluminous for treatment in our columns. All we can hope is that this addition to company legislation will have its intended effects, and ensure to the public greater safety and protection from the snares that beset in connection with joint-stock undertakings.

Prorogation of Parliament.

Our jaded legislators left Westminster greatly relieved last Wednesday. The work of the session has been exceedingly heavy; for the Government have, with unpitying zeal, kept the elect of the people close at their labours on an assortment of public measures which, in the aggregate, looked terribly formidable. Quantity has, in fact, taken precedence of quality; and in more than one part of the House murmurings have been heard of hardship and precipitate legislation. These are times when every question petitioning for legislation should be rigorously examined; but it cannot be asserted that the whole of the legislation of the past session has received the consideration that it should have had. When the names of the measures passed come under review, it is striking how few of those of first importance mentioned in the King's Speech at the opening of Parliament have become law—the long list before us being made up for the greater part of Acts of second-rate importance. The amendment of the patent laws was one of the subjects noted in the King's Speech at the opening of the session; and it has been honoured by reference in the King's Speech at the close of the session. The Act has been received with mixed views as to its prospective blessings and otherwise. But manufacturers and commercial men on both sides of the House of Commons welcomed the measure with open arms; and the House of Lords had not much fault to find with it. Lawyers were doubtful, and prognosticated a great increase in litigation. But generally in the manufacturing and commercial world it is believed that, as said in the King's Speech, the Act will restrain the abuse of monopolies, and strengthen the provisions in regard to the revocation of those British patents which are worked abroad, but which are not being adequately worked in this country. The Companies' Act and the Employers' Liability (Insurance Companies) Act have also been passed. The Companies' Consolidation Bill was dropped; and with regard to the much-agitated subject of the hours of labour in mines, though three measures were introduced they were afterwards withdrawn. The Government, however, has already another Bill drafted for their programme next session, which Bill has for its intent the statutory limitation, by stages, to eight hours of the miner's day from bank to bank. The Valuation of Property (England and Wales) Bill was promised, but was not introduced. The Government have enough remainders and unaccomplished work to last them through another session, without taking upon themselves anything fresh. Outstanding among other questions of general importance were the novel fiscal proposals of the Chancellor of the Exchequer in submitting his budget. Everyone knows now that earned incomes are to receive (as they deserve to receive) a reduction of 25 per cent. of the income-tax. But unearned incomes, including the incomes of those who have provided for old age by thrift, are to continue to bear a tax of 1s. in the pound. This remark calls to mind that the Chancellor of the Exchequer hopes to have in hand next year £1,500,000 which he expects to be able to set aside for old-age pensions. How much of this sum will be provided by those who have made their own provision for old age? The gas legislation of the session was dwelt upon last week; and there is now nothing further to add.

Overlapping Gas-Supply Districts in the Midlands.

From an article in another part of the "Journal" it will be seen that a curious position of affairs has arisen in connection with the gas supply of Draycott and the adjacent village of Breaston. These places are within the area of the Long Eaton Gas Company, but as no steps were taken to afford a supply of gas, a Company was formed at Draycott about twenty years ago to undertake this work, which they were allowed to carry out. It appears that they have given general satisfaction to the consumers; their prices ranging from 2s. 6d. per 1000 cubic feet to 1s. 6d. for gas used for engines. The Company's position has, however, lately been assailed by the Long Eaton Company laying a 12-inch main through Breaston to Draycott, and offering a supply of gas at 2s., accompanied by the inducement of free fittings. This action, though it has led the Draycott Company to lower their maximum charge to 2s., does not seem to have been well regarded by the consumers, for we learn that there exists "a general feeling of resentment against the new-comers." It is thought that there is an ulterior motive behind the concession made by the Long Eaton Company, whose price in the town is 3s., less 10 per cent. Nor are the Company's consumers altogether satisfied, as they think that if gas can be conveyed several miles and then sold profitably at 2s., they at the fountain head must be greatly overcharged. It appears that meetings of the shareholders are to be held to consider this and other matters; so that more will be heard of it. Meanwhile, it may be suggested that, as there is right on both sides, a spirit of conciliation should be shown, which might lead to some satisfactory arrangement. After having been twenty years in uninterrupted possession of a district which they were the first to supply with gas, it seems, on the face of it, rather hard that the Draycott Company should be subjected to the competition which has been sprung upon them. But we shall hear what the other parties have to say.

Municipal Trading Drawbacks.

People who believe in municipal trading are usually of an optimistic temperament, and, though confronted with disagreeable facts opposed to all their fine theories, they are firmly convinced that all will come right some day. Success and failure in municipal enterprise mean practically the same thing to its friends. A business may not pay, rates may advance, debts be piled up, and current accounts be overdrawn. The public may

even have to put up with an indifferent, cramped, or costly service at the hands of the municipality, compared with that which a company would have afforded. Still the municipal trader sees bright visions ahead, and is quite content to pay—and let other people pay—high rates because of the advantage which he is convinced will accrue to somebody in a future more or less remote. No doubt this optimism partly arises from a natural reluctance to face unpleasant truths. It is of no use going to meet trouble; and so long as ratepayers do not rise in open revolt, their representatives on the municipal bodies may find excuse for not scrutinizing too closely the financial and other results of some of those grand schemes on which they have embarked. From time to time facts have to be faced, however unpleasant the duty may be; and the optimist then has need of all his philosophy. The promoters of the electric lighting undertaking at Barnstaple have been sorely tried of late. This is one of those grand schemes which, when started, was going to effect a revolution in the old Devonshire town. There was to be lighting for next to nothing, and no one knew how much profit to go towards the reduction of the rates. What has really happened is a not uncommon experience. The municipal electric light has been used to light the streets at a cost two or three times greater than that at which they could have been more efficiently lighted with gas. Though the rates have thus been indirectly drawn upon to bolster up the undertaking, the revenue account still shows a deficit, and the bank overdraft has grown to something like £3500. Attention was called to this unsatisfactory state of the finances at a meeting of the Town Council yesterday week. It was pointed out that the payment of bank charges on an overdraft which ought never to have been incurred is illegal, and that it is in the power of any burgess to obtain a *mandamus* to compel the Council to raise, by means of a rate, sufficient money to clear off this debt. It does not appear to be likely that anyone will take this action, which would be attended with very unpleasant consequences for many people who are not responsible for the Council's wrong-doing. Some such strong measure as this may, however, be needed to remind certain municipalities that the law exists, and can be made operative. In the case of Barnstaple, it was decided that the Borough Treasurer should produce at each monthly meeting a statement showing how the accounts stand after payment of all bills that are due. This will at least show whether or not the Council are getting deeper into debt; and it may act as a check upon reckless or unnecessary spending.

PERSONAL.

Mr. Evan Rees, of the Neath Corporation Gas-Works, has been appointed Manager of the Blaina Gas-Works.

Mr. Ernest Moon, K.C., one of the leaders of the Parliamentary Bar, has been appointed by Mr. Lowther as Speaker's Counsel, in succession to the Hon. Sir E. Chandos Leigh, K.C.B., K.C., who has retired, after filling the position since 1883. Sir Chandos Leigh is closely connected with the gas industry; being a Director of the Imperial Continental Gas Association.

OBITUARY.

The death occurred recently, at the advanced age of 87, of Mr. T. R. Richardson, who was for some years the Secretary of the Woolwich Consumers' Gas Company. In 1861 he was in the Company's service as a collector; but a few years later he obtained the higher appointment, in succession to the late Mr. I. A. Crookenden, who became Secretary of the Phœnix Gas Company. On the amalgamation of the Woolwich Companies with the South Metropolitan Gas Company in 1885, Mr. Richardson retired upon a superannuation.

We regret to learn of the recent death, at the age of 55, under painful circumstances, of Mr. John Whitehead Carr, the Manager of the Municipal Gas-Works at Johannesburg. He was on a visit to his daughter, and appeared to be in his usual health. While engaged in conversation, he was suddenly taken ill; and he expired, as the result of heart failure, before medical assistance could be obtained. Deceased was a brother of the late Mr. William Carr, of Stalybridge, and of Mr. Isaac Carr, the Gas Engineer of the Widnes Corporation. It may be remembered that the works at Johannesburg were designed by Mr. Thomas Newbigging, and their erection was superintended by Mr. William Carr, who returned to England in 1892. He was succeeded by his brother John, who managed the works continuously (with the exception of a short period during the war in the Transvaal, when he returned for a time to England) till his death. He was elected a member of the Gas Institute in 1893, and in due course passed into the Institution.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 645.)

Movements last week on the Stock Exchange in the prices of leading issues were irregular and uncertain; and—unlike the preceding week which closed better than it opened—the moderate advance of the earlier days was lost in the later ones. It was account week; and fresh business was not abundant. Happily the settlement was not a formidable affair. A favourable anticipation of this operation imparted some cheerfulness to the opening, especially choice investment lines. Consols improved $\frac{5}{16}$, and Home Rails were pretty strong; but the American market was a weak spot. Tuesday improved further on this position; and under the influence of both speculative and investment buying, there was a fair advance in prices—Consols scoring another $\frac{1}{4}$. On Wednesday, the tide was still flowing favourably, and Consols and Home Rails were carried up still higher. But on Thursday the tide ceased; and there were symptoms of a general arrest. The rise had brought in realizations to secure profits, and prices shrank accordingly—Consols being a loser of $\frac{3}{16}$. The adverse influence continued on Friday, prompted to a large extent by foreign dealings and monetary movements; and Consols fell another $\frac{1}{8}$. Saturday was no worse—indeed, some leading foreign departments were better; and Consols were steady. In the Money Market, there was a very abundant supply for loans; and all requirements for the month's end and for the Stock Exchange were easily met. Discount rates were on a falling scale, but became firmer before the close. Business in the Gas Market was of decidedly slender proportions—quite the quietest week we have so far had. But the condition of stocks was unimpaired by the absence of support, and a good many of the quotations moved upward nicely. In Gaslight and Coke issues, the ordinary was lightly touched every day; and after an opening bargain at 92¾, the price was pushed up to 94, at which it was very steady—a rise of 1. The secured issues were fairly active for them. The preference changed hands at from 103¾ to 105; and the debenture at from 81½ to 82½—a fall of 1 in quotation. In South Metropolitan, after a small parcel had been done free at 118½, there were dealings at from 119 to 120—a rise of ½. In Commercials, the 4 per cent. marked 106½ *cum div.* and 102½ *ex div.*; the 3½ per cent. 100½ *ex div.* The Suburban and Provincial group were strong and quiet. Alliance old was done at 20½ and 20 11/16; Brentford old at 250; British at 42; South Suburban at 117½; ditto debenture at 124; West Ham at 102 and 102¼; ditto preference at 118⅝ and 120. The Continental Companies were extremely inactive. Imperial advanced a point, with business done at 174½ and 175; European fully-paid marked 22⅝; and Union was not dealt in. Among the undertakings of the remoter world, Buenos Ayres changed hands at 11 3/32, ditto debenture at 94¼; Primitiva at 6 15/16, ditto preference at 5 3/32; River Plate at 13¼; ditto debenture at 93½ and 94¾; San Paulo at 13¼; and Oriental at 144.

ELECTRIC LIGHTING MEMORANDA.

Municipal Electricity Trading—Some of the Reasons for Poor Results—Deficits and Narrow Net Profits in the Metropolis and Provinces—Revenue from Street Lighting—Losses and Inadequate Depreciation in 1906.

About this time of the year, we have the opportunity, through the particulars published in the electrical press, of calling attention to the seamy side, financially, of municipal electricity supply. It is necessary to be candid on the subject, as our electrical contemporaries may rise up in wrathful indignation (as one did some time ago), and charge us with not being impartial by neglecting to call attention to those undertakings that have done well, as shown by accountancy fair or suspicious. Whether fair or otherwise, it is not always possible to say without having the complete accounts before us. Let us make the position clear. As exhibited by the published figures, many electricity undertakings have been successful; but from all parts of the country, we have a goodly collection of undertakings that have fallen far short of the prophecies, and of the handsome contributions that they were going to make to the relief of the rates. There are some that have made contributions; but we do not know of many instances where this has been anything better than a sham when the increased expense of public lighting is brought up as a contra account. In pointing to representative undertakings in all grades of the business that have not in the last municipal account year done anything conspicuously good from the financial point of view, we are taking them from all parts of the country; and it will therefore be no use charging us with unfairness in selection on the ground that the poor financial result is due to local circumstances. If these were altogether to blame, then we should say that the success of the other undertakings is also due to local conditions (included in which in some cases is superior administration); and that the local conditions of these concerns cannot possibly avail those undertakings that show a poor result, and are struggling with adverse local conditions that had existence when the ruling authority were tempted and advised to launch out into speculation. There are towns the conditions of which have been proved by a big

sacrifice of money to be totally unsuitable for profitable electricity supply. Complaint is made in several places that the increase in private consumption is not going on at the rate expected, that capital charges and interest are advancing out of proportion to the increasing business, that the shortening of the period for loans (which is found necessary in the cause of sound finance) presses somewhat heavily, that the pressure of gas competition necessitates lower charges for electricity, and that the dearer coal markets are making the outlook very dull. For example, as mentioned last week, Derby reports an increase in the coal bill of £1000; Newport (Mon.), of £1192; and West Ham, of £2580. Assessments for rating are also ascending, where local authorities do not favour their own trading undertakings. In the face of these uncomfortable circumstances, the price of electricity has to be reduced to compete with gas. Cardiff and Ipswich (among other places) can tell one something about this, and the effects. The higher efficiency electric lamps are also coming into the swim to add to the immediate difficulties of electricity suppliers. But we are interested to see that the ardour of many local authorities for getting money out of the undertakings in aid of the rates is diminishing. Hope cannot be sustained by recurring deficits or lean profits. Of all reasons why the results are so bad in many towns, the greatest is that there is not the scope for the business, with excellent value offering by the gas undertakings.

Having made it quite clear, to please our electrical friends, that the municipal undertakings whose results are here noticed are not (although the figures themselves make the point obvious) representative of those that have been successful, we will first turn to certain of the London concerns. The figures should be prefaced with the remarks that the information available does not afford knowledge, in many cases, as to how reserves and depreciation have been dealt with, whether fair payments have been made for establishment expenses, whether the undertakings are properly assessed, whether other departments have lent a helping hand, and whether public lighting has been drawn in as a big contributor of support. However, Bermondsey declares a balance of net profit of only £590. Ealing takes credit for a net profit of £1768, which is £550 less than the preceding year. Finchley has a deficit of £170; but one of our electrical contemporaries trots out the stale claim that this must not be regarded as loss, seeing that the local Gas Company have reduced their price from 4s. 5d. to 3s. 8d. per 1000 cubic feet of gas. Electricians seem to cherish the notion that reductions of gas prices only set in with their advent as competitors. Reductions in the price of gas commenced a century ago; and we do not think any electrician who does not wish to be written down as a dolt will say the gas industry has been standing still since electricity opened up its competition. It is forgotten—or perhaps it is not known—by some electricians that most gas companies are now working under the sliding-scale of price and dividend, whereby dividends are increased by reductions of charge, decreased by increases, and stand still if there is no change in price. There is inducement here apart from competition. But to proceed. Hammersmith realized a net profit of £14, compared with £2631 in 1905-6 and £5283 in 1904-5. The gross profits of Hornsey only advanced by £854; the deficiency being £1153. There was a balance overdrawn in the previous year of £267; so that the ratepayers have to provide, for the privilege of allowing certain folk in the district to use electricity, a sum of £1421. We notice several undertakings like Poplar that find it difficult to put a different complexion on their finance, though reporting increased outputs of electricity. Poplar takes credit for a net balance of £574; in the previous year for £600. In St. Pancras, the Council report a decrease in the number of units of electricity sold—from 1,628,803 to 1,597,750—owing to a decline in the demand for power; only 293,248 units having been sold under this head, against 418,251 units in the previous year. At West Ham, the deficiency was £1830. We have not seen any statements from the whole of the Metropolitan Borough undertakings; but these are the least satisfactory of those that have been published, and, as will have been remarked, they form a good proportion of the whole.

Let us now look round the Provinces. Many of the big undertakings distributing in choice parts have not done so well, from the net profit point of view, as in some previous years; but mention is here made of only those concerns that have kept a little above or a little or much below the line dividing net profit from deficit. Accrington shows on the financial year a net profit of 7s. 3d.; Batley, of £494; Beckenham, of £463, as compared with £799; Blackburn, of £1528; Brighton, a deficit of £10,233, and a reduced consumption; Broughty Ferry, a net profit of £127; Buxton, a deficit of £3; Cardiff, a deficit of £4638 (in the previous year a net profit was shown); Carlisle, a net profit of £9; Cleckheaton, a deficit of £193; Colchester, a net profit of £1224 (a reduction of over £500); Darwen, a net profit of £66 (another source of information states £96); Dover had to take £653 from the previous account and £470 from reserve to make both ends meet; and Dudley reaped a net profit of £68, against £323. At Eastbourne, the gross profit was £1210 more than in the previous year; but the net profit was only £1568, or an increase of £266. Elland shows a deficit of £476; Farnworth, a net profit of £300; Gloucester, a loss of £842; Govan, a net profit of £547; Gravesend, a net profit of £245; Hove, a deficit of £592; Hull, a net profit of £1813; and Ilford, a net profit of £885, as compared with £1870. Ipswich did very badly; the deficit being £1363, compared with £249. Here, however, a reduction in price was made; and the Engineer reports that it brought a number of new consumers, but the new business during the year was a long way short of what was expected. The number of consumers increased from 284 to 372; yet with this increase the deficit was much larger. Kendal exhibits a deficit of £715; Kettering, an adverse balance of £1016; King's Lynn, a net profit of £593; Kirkcaldy, a deficit of £39; Lancaster, a net profit of £369; Longton, a deficit of £202; and Morecambe, a deficit of £1734. Newport (Mon.) is interesting. A deficit there of £2286 succeeds a deficit of only £372 in the preceding year. Yet some time ago there was an electricity exhibition held in the borough, about which some good things were said, and around which great expectations were formed. Cruel fate leaves in the accounts an outstanding balance on the exhibition of £206. It is safe to say there will not be another electricity exhibition in Newport just immediately. Leigh shows a deficit of £409, compared with a net profit of £219 in 1905-6; Loughborough, a deficit of £1112; and Oldham, a net profit of £1459, but, after deducting the deficit for the preceding year, the carry-forward is only £91. The accounts of Sheffield present a net profit of £2555 (compared with a deficit of £1374); but Sleaford (Lincs.), by including the balance from last year, do not appear (so far as the published accounts can be interpreted) to have met their liabilities. The electricity department of the Stalybridge, Hyde, Mossley, and Dukinfield Board incurred a deficit of £5466; Sunderland one of £690, against a net profit in the previous year of £1429; and Sutton Coldfield, one of £99. Swansea claims a net profit of £741; Taunton, of £335; and Warrington £2516, against £2762. Whitby shows a net deficit of £1935. At Wigan the electricity department and the tramways are run together; and there is great dissatisfaction with the financial position. On the electricity department, a net profit of £2489 is declared; on the tramways, a total deficit of £18,563. Wishaw shows a deficit of £593; and Yarmouth, a net profit of £1118.

Many an electrical undertaking would be in the depths of Queer Street if it were not for the public lighting, for which they charge the ratepayers enormously for the illumination of a very small mileage of streets. It is noticed that the income from street lighting in Cardiff is no less than £8394; still, as mentioned above, the deficit is £4638 on last year's trading of the undertaking. The Crewe concern had an income from the sale of electricity by meter of £3078, and from public lighting of £3358; the surplus on the year being only £680. The sale of current for lighting, power, and traction at Erith produced £8156, and for street lighting £2199; the deficit on the year's working being £68. At Hastings £15,134 was derived from the sale of current for private lighting and power, and £3960 from public lighting; the net profit on the year being merely £198, or an increase of £81. At Wimbledon, the receipts from the sale of current amounted to £18,230; and the revenue from public lighting was £5730. Through the public lighting here, the ratepayers are badly hit; seeing that this is the price paid for the supply to 62 arc lamps and 1081 electric incandescent lamps.

The Industrial Freedom League have lately issued a leaflet on the results of the trading in electricity supply for the twelve months ending March, 1906. Complaint has been made that this was circulated after certain municipal accounts were published, disclosing improved results; but the League are dealing with a complete year's working, and the complete statistics are not yet available for 1906-7. In good time, the League will have them, and then doubtless there will be issued another circular; the prospects being, so far as we can judge at present, that the results in the aggregate will not look much better than those for 1905-6. The circular points out that the accounts disclose a considerable number of deficits; and in many instances very small balances of receipts over expenditure. In the majority of undertakings, there was no provision at all made for depreciation; and where depreciation was provided for, the amount set aside for the purpose was generally inadequate. On March 31, 1906, of 217 electric light undertakings which had been worked for twelve months or more by local authorities, 143 claim to have made a profit, and 74 admit a loss. The total expenditure charged to capital amounted to £32,929,734—excluding the St. Marylebone undertaking (£1,824,884), which the Borough Council did not commence to work till August, 1905. The net "profit" claimed, after the necessary provision had, in most cases, been made for interest and sinking fund, but before providing for depreciation, was only £478,675, or about 1⅞ per cent. Of this profit, nearly one-half (£230,108) was made by nine of the 143 local authorities on a capital expenditure of £8,366,975. The balance of £248,567 therefore represents rather less than 1 per cent. profit on the remainder of the capital expenditure, amounting to £24,562,759. The losses made in respect of 74 undertakings, or 34 per cent. of the total number, amounted to £82,161. Nearly three-fourths of the undertakings worked at a loss had been in operation for periods varying from three to fifteen years. The receipts of seven of the 74 undertakings were not sufficient to cover their working expenses.

Regarding depreciation, the circular informs us that the sum placed to depreciation and reserve, and in some cases devoted to expenditure of a capital nature, amounted to £318,504, or an equivalent of rather less than 1 per cent. on the total capital expended. A moderate allowance of 2½ per cent. for depreciation on the capital expenditure of £32,929,734, all of which cannot now be considered as productive, would amount to about £830,000. Deducting the losses, £82,161, from the profits of £478,675, there is a net balance of £396,514, or a profit of less than one-half

the sum which should have been placed to depreciation, on the very low basis of 2½ per cent. Only 96 authorities of the total of 217 provided for depreciation. It was not, however, in every case made out of profits, but was obtained in some instances by carrying an adverse balance to the account of the following year. The nine local authorities previously referred to placed to depreciation or reserve £178,509, or a little more than 2 per cent. on capital expenditure of £8,366,975. The balance—£139,995—of the total sum of £318,504, therefore, only represents about ½ per cent. as the depreciation and reserve on the remainder of the capital expenditure, amounting to £24,562,759.

In a summary of the accounts up to March 31, 1906, of the electric light undertakings carried on by London Borough Councils, published on the authority of the London County Council, it is shown as the general result of the fourteen undertakings (excluding Bethnal Green, which did not give a supply, and St. Marylebone) that since their establishment contributions from the rates had been made amounting to £63,806. On the other hand, contributions in relief of the rates had only totalled to £28,452; but the allocation of £18,220 of this sum by the St. Pancras Council has been stated to be premature. On the fourteen undertakings, none of which has been started since 1902, there had been altogether devoted to replacements, written off capital expenditure, or standing to the credit of renewals and reserve funds £184,053, or little more than 5 per cent. on a capital expenditure of £3,608,121. Battersea and Woolwich had no renewal or reserve fund.

WORKMEN'S COMPENSATION STATISTICS.

Of much the same character as previous reports are the Home Office statistics of proceedings during the year 1906 under the Workmen's Compensation Acts, 1897 and 1900, and the Employers' Liability Act, 1880. The tables contained in the return give all the information which is available; but it is, of course, impossible to make the particulars anything like complete, inasmuch as, in the majority of cases, compensation is settled by agreement between the parties concerned, in which event no official figures are procurable. Thus the report perforce leaves untouched the great bulk of the instances in which compensation is paid to workmen. It may be mentioned that the comparatively limited sources which provide the data given are the following: Returns by the Registrars of cases which come before the County Courts, and of instances in which memoranda recording agreements or awards by private arbitrators under the Workmen's Compensation Acts are registered; certain particulars of cases carried to appeal, supplied by the officers of the Supreme Court; particulars of all official references to Medical Referees, available in the Home Office; details as to certified schemes, obtained from the Chief Registrar of Friendly Societies; and certain information as to the charge for compensation incurred by railway companies, which is available from the returns made by the companies to the Board of Trade. The report is divided into three portions, covering respectively England and Wales, Scotland, and Ireland.

Taking England and Wales first, we find that in 1906 the number of cases under the Workmen's Compensation Acts that were actually dealt with by County Court Judges and County Court Arbitrators was 1718; and of these 1404 were decided by Judges and 74 by a Special Arbitrator, while 240 cases were settled by acceptance of money paid into Court. In addition to the cases adjudicated upon, there were 814 which were withdrawn, settled out of Court, or otherwise disposed of in such a way as not to enable the officials to state definitely the results. The total number of cases taken into Court was thus 2532, as against 2469 in 1905, and 1347 in 1899. As to the nature of the decisions come to, it may be remarked that of the claims settled within the cognizance of the Courts, 1179 cases resulted in favour of the applicant, and 245 in favour of the respondent. The proportion of successful claims was thus 83 per cent., which figure compares with 82 per cent. in 1905 and 1904, and 84 per cent. in 1903. The number of cases in which compensation was awarded on account of the death of workmen leaving dependants was 553; the corresponding figure for 1905 having been 538, and that for the first complete year during which the Act was in operation (1899) 219. The total sum awarded last year in the 553 cases of death in which the deceased left dependants, was £105,454; and the average amount was £190 13s. 11d.—slightly more than in any of the preceding seven years. This includes both cases in which the deceased left persons wholly dependent (in which the Act stipulates that the compensation shall range between £150 and £300), and those in which partial dependants were left (when the compensation is to be proportionate to the injury to these partial dependants). There were 111 instances in which amounts of less than £150 were awarded; the total being £9263, or an average of £83 9s.

Coming to the cases of injury, the assignment of a weekly sum was again the most general method adopted; there having been 124 cases in which the compensation was returned as consisting of a lump sum, and 501 in which a weekly payment was fixed. In 17 of the cases in which a lump sum was paid, the claimants accepted the amounts paid into Court; while in most other instances the award of a lump sum was apparently made by consent of the parties. The average amount was £36 3s. 11d. Unfortunately, as regards weekly payments, though the rate assigned is given, it is only possible in a few cases to state the length of time covered by the payments; and therefore a complete calculation of the capitalized value of the grants is out of the question. However, with the mutually agreed schemes certified by the Chief Registrar of Friendly Societies, the average duration of cases of incapacity lasting more than a fortnight (excluding those which continued for a period of over six months) was 5·2 weeks. This may be taken as a rough guide, to some extent, though it is pointed out in the report that the average duration of contested cases would doubtless be higher. In cases of injury in which weekly sums were assigned last year, the average amount per week in instances of total incapacity was 11s. 6d., and in those of partial incapacity 9s. 10d. The Acts of 1897 and 1900—to which, of course, the present returns apply—embraced forms of employment which are placed under seven heads. These are railway, factory, mine, quarry, engineering work, building, and agriculture. Of the total number of cases taken into Court in 1906, nearly one-half came under the heading of "factory"—that is to say, 1183 out of 2532.

The next set of particulars given are those gathered from memoranda registered in County Courts, having reference to cases settled by agreement or private arbitration. It is shown that 5096 cases were settled by agreement, 68 by committees representative of employers and employed, and 7 by an agreed arbitrator. The number of instances in which memoranda have been registered in this way has steadily increased year by year—the total having been 4317 in 1905 as compared with 5171 last year. In these agreed cases, the average compensation awarded to dependants in connection with fatal accidents was last year £167 9s. 7d.; while the average weekly payment in instances of incapacity was 13s. 3d. A lump sum for incapacity was fixed upon in 1564 cases, and a weekly payment in 2229 cases. The average lump sum compensation paid was £41 13s.

Another division of the report is devoted to cases under the Employers' Liability Act; and these statistics are simpler than the foregoing, because there are no arbitrators (all cases come into Court), and the damages awarded can always be stated as a lump sum. Last year witnessed a still further falling off in the number of actions brought under the Act; the figure being 476, as compared with 481 in 1905, 598 in 1904, and 688 in 1897—the year of the passing of the first Compensation Act. Of the 476 cases last year, judgment was given for the plaintiff in 114, and for the defendant in 83—leaving 279 which were "otherwise disposed of." The amount of damages awarded was £9342. Perhaps some explanation of the falling off in the number of cases under the Employers' Liability Act is to be found in the amounts awarded in 1904 and 1905 in connection with proceedings regarding fatal accidents under that Act, as compared with those taken in accordance with the provisions of the later Statute—the Workmen's Compensation Act. If this is so, however, last year's awards may do something to modify these ideas; for the average amount of damages given in 1906 under the Employers' Liability Act, in case of death, was £192 13s., as against the £190 13s. 11d. under the Workmen's Compensation Acts. Proceedings under the latter, however, again proved the more advantageous in the matter of expense.

Just over 2 per cent. of the cases under the Compensation Acts that came before County Courts were taken to the Court of Appeal. To be precise, the number was 57, as against 97 the previous year, and only 34 in 1904. Of the total of 57 appeals last year, 35 were by workmen, and 22 by employers. Five of the former and five of the latter were successful; while 19 appeals were abandoned, withdrawn, or settled out of Court. Two cases were taken to the House of Lords—both by workmen; and in one instance the appellant was successful. The points over which the appeals arose are instructive reading; and glancing down the list, one is struck by the frequency with which "Definition of the word 'factory'" appears. The two appeals which were heard by the House of Lords turned on the meaning of the words "serious and wilful misconduct" and "on, or in, or about an engineering work."

With regard to Scotland, it is stated that during 1906 the number of cases taken into Court under the Compensation Acts was 370, or 82·7 per million of population, as against 77·8 cases per million in England. The cases under the Employers' Liability Act numbered 155, or 34·7 per million of population, as compared with 14·6 cases per million in England. In cases of death, the average amount paid in compensation where dependants were left was £171 15s. 10d. when decided in the Sheriffs' Courts, and £189 10s. 2d. where memoranda were registered. In cases of incapacity, the lump sum figures were respectively £8 7s. 5d. and £31 12s. 9d., and the weekly payments 10s. 10d. and 13s. 2d. In Ireland there were last year 256 cases under the Compensation Acts, against 187 in 1905. The average amount of compensation in cases of death with dependants was £130 14s. 9d. when decided in the County Courts, and only £75 13s. 5d. where memoranda were registered. In connection with claims for accidents causing incapacity, the lump sum figures were respectively £20 12s. 9d. and £68 18s. 5d., and the weekly payments were 9s. 3d. and 10s. 11d.

The late Sir William Henry Perkin left estate valued at £78,611 gross, with net personalty amounting to £25,727. By his will, he has left all his scientific apparatus, specimens, books, manuscripts, and calculations on chemical subjects, to his three sons.

METROPOLITAN WATER BOARD.

The Fourth Annual Report.

In the "Journal" last week, we gave some statistics in regard to the supply of water to the Metropolis in the year ending the 31st of March last, extracted from the fourth annual report of the Metropolitan Water Board, which has lately been issued. We now deal with the engineering features of the report.

It is satisfactory to find that the Board recognize the importance of the storage of water, not only as a provision against dry seasons, but also to ensure the quality of the water, and that they have given this matter their most careful consideration. The Director of Water Examinations (Dr. Houston) has pointed out that if water is stored for weeks or months, the probability of harmful bacteria surviving becomes excessively remote; and he states that "water stored sufficiently long, even if turbid or unpalatable, is, in the light of present knowledge, incapable of giving rise to epidemic disease." We are pleased to put this statement on record, as it supports views which have been expressed from time to time in our columns. We confess to a belief in the *vis medicatrix naturæ*, especially in relation to the self-purifying power of water when left for a time undisturbed. It should be gratifying to residents in London to learn that the effective amount of storage and subsidence reservoir capacity for unfiltered water possessed and in use by the Board at the end of the year covered by the report was as follows:—

	No.	Area in Acres.	Total Capacity in Million Gallons.
Thames Valley . . .	30	918·50	6345·5
Lea Valley	17	530·25	2499·2
Total . . .	47	1448·75	8844·7

During the year, the number of reservoirs was increased by four (those at Walton and Kempton Park), with an area of 187·5 acres and a capacity of 1498 million gallons. To the totals given in the above table may be added the following, in the New River district, which are included in the monthly reports of the Official Water Examiner (Mr. Charles Perrin, M.Inst.C.E.):—

	No.	Area in Acres.	Capacity. Million Gallons.
Hampstead and Highgate ponds .	12	28·75	29·0
Camden Park reservoir for the pond water	1	1·00	0·9
Cheshunt (disused)	2	18·50	39·0
	15	48·25	68·9
Making a total of . .	62	1497·00	8913·6

In two tables appended to the report are given particulars as to the distribution of the Board's storage reservoirs among the several districts, their average capacity per acre, and the number of days' supply they represent according to the supply in the year 1906-7. The average capacity per acre ranges from 8·561 million gallons in the Southwark and Vauxhall division and 7·872 million gallons in the Staines reservoirs to 2·898 million gallons in the New River district, or 1·689 million gallons excluding the Kempton Park reservoirs; the general average being 5·954 million gallons per acre. The number of days' storage is 39·62 for the whole area, compared with 34·02 days last year, notwithstanding an increase in the supply of 7 million gallons a day. In the eastern district, the storage capacity represents 57·19 days; and in the Southwark and Vauxhall division, 51·12 days. The tables also show the quantity of water in store at the end of each month, the increase or decrease between the beginning and end of the year, and the number of days on which no river water was abstracted.

Two large reservoirs at Walton, which were commenced by the Southwark and Vauxhall Water Company in 1901, were completed during the year 1906-7, and were formally opened by the Chairman of the Board on the 13th of April last, as recorded in the "Journal" at the time. The Board have named the reservoirs the "Knight" and "Bessborough" respectively, after Lord Bessborough, one of the Directors of the Southwark and Vauxhall Company, and Sir Henry Knight, the Chairman of the Company at the date of the transfer. The "Knight," or western, reservoir has a capacity equal to 480 million gallons, and a water area of 51½ acres; and the "Bessborough," or eastern, reservoir has a capacity of 718 million gallons and a water area of 74 acres. The work entailed 1¼ million cubic yards of general excavation, the same quantity to form the embankments, 200,000 cubic yards of puddle, and 75,000 cubic yards of portland cement concrete. The lining of the reservoirs contains 13,000 superficial yards of brick paving and 13,000 lineal feet of coping—equal to nearly 2½ miles. The cost of the work was approximately £419,000.

The intake for the reservoirs consists of three tunnels, each 12 feet by 8 ft. 6 in., commanded by three "Stoney" sluices with screen chamber and other accessories. The machinery for this station will be capable of pumping 100 million gallons from the river every 24 hours for the supply of the reservoirs. Connecting these works with the existing reservoirs and the filters at Hampton are two lines of mains, each 48 inches diameter, which have been laid to a point on the southern bank of the River Thames, whence they descend by means of a cast-iron shaft to a tunnel under the river, through which the mains pass to the northern side, where they are to be connected with the Staines reservoirs. The whole of the works were designed and superintended by Mr. Restler, the Board's Deputy Chief Engineer, and formerly Engineer to the Southwark and Vauxhall Company.

The East London Water-Works Act of 1900 authorized the construction in the Lea Valley of two storage reservoirs of a total capacity of 5000 million gallons. Practically the whole of the land required for the reservoirs has been purchased, the total cost of acquisition being £76,064, of which £22,071 has been expended by the Board since they entered into possession of the undertakings. The total area of the site is about 980 acres. The time for the construction of the reservoirs has been extended to seven years from the passing of the Board's Act of last year. In November the Board determined to proceed with one of the reservoirs (to contain 3000 million gallons), and the necessary plans are in course of preparation; an estimate of £550,000 for the work having been approved.

Under the Lambeth Water-Works Act, 1900, the Board are authorized to construct a reservoir of an approximate capacity of 1000 million gallons on land at Island Barn, situated in the parishes of East Molesey and Walton-on-Thames. The time specified for the completion of the reservoir expired on the 30th of July last; but provision is made in the Board's Various Powers Bill of the session just closed for the extension of this period for seven years. The approximate estimate of the cost of the reservoir is £250,000; and the Board voted this sum for the work.

The total storage in existence, in course of construction, and authorized, but not commenced, is as follows:—

	Thames. Million Gallons.	Lea. Million Gallons	Total. Million Gallons.
Existing storage	6345·5	2538·2	8,883·7
In immediate contemplation	1000·0	3000	
Authorized by Parliament, but not yet commenced .	—	2000	6,000·0
Total	7345·5	7538·2	14,883·7

The 8883·7 gallons of existing storage is exclusive of the Hampstead and Highgate ponds and the Camden Park Road reservoir for pond water.

Another table shows the working of the Staines reservoirs—viz., the average daily supply, total volume delivered each month to the New River and western districts (Grand Junction and West Middlesex divisions), and the quantity in store at the end of each month. The actual quantity of water supplied from these reservoirs during the year 1906-7 was 7901·8 million gallons, or a daily average of 21 6 million gallons, of subsided water—an increase of nearly 29·5 per cent. over the preceding year. Of the total quantities supplied from the reservoirs, the New River district took 15 per cent. and the western district the remainder. In the Board's second and third annual reports, reference was made to the Kempton Park storage reservoirs, which had been commenced by the New River Company in order to enable them to utilize their right to one-third of the water from the Staines reservoirs. The two reservoirs at Kempton Park, having a joint capacity of 300 million gallons, and with an area of 62 acres, were brought into use during the year; the New River district first taking water from the Staines reservoirs for filling Kempton Park reservoirs on April 30, 1906. On Dec. 3, 1906, the Kempton Park pumping-station and reservoirs were used for the first time for affording a supply to the eastern district; the Thames intake of that district at Sunbury having been closed from that date.

In April, 1905, the Board approved an estimate of £152,400 for the completion of the Staines (New River) communication works. A tender has been accepted for £23,532 for the making, testing, and delivery of the 42-inch and other cast-iron pipes required for the portion of the aqueduct between Child's Hill and Cranley Gardens (Fortis Green), and a further tender of £27,425 for the laying of the main. Tenders for the sluice-valves in connection with the aqueduct from Child's Hill to Cranley Gardens and with the Fortis Green reservoirs have also been accepted, amounting to £2132. A tender of £60,279 was accepted in July, 1906, for the construction of the two service reservoirs at Fortis Green in connection with the Staines reservoirs communication works; and another for £4472 for making, testing, and delivering 42-inch and other cast-iron pipes and castings required in connection with the reservoirs.

In connection with the Staines reservoirs communication works of the New River District, the Board have had to consider the improvement of the supply to that district in view of the addition of Tottenham and Enfield, and of the rapidly increasing population. The Board adopted a scheme arranging for the delivery of an additional daily quantity of 10 million gallons of unfiltered water from the East London reservoirs into the New River channel at Stoke Newington *viâ* the old 36-inch main from which the New River Company used to obtain water from below Tottenham Mills more than forty years ago. To enable this 10 million gallons to be lifted into the New River channel, a steam-turbine pump, with accessories, was authorized to be fixed at the Ferry Lane station of the eastern district. The Board hope that with the completion of the main from Child's Hill to Cranley Gardens and thence to Hornsey (which latter portion alone remains to be commenced) considerable improvement will be effected in the water supply to the New River district, and consequential relief afforded in other districts.

Coming to the subject of filters and filtration, it was reported

last year that the Board had authorized the construction of new filter-beds at Hampton, of about 6 acres in area, to improve the supply to the district, at an estimated cost of £60,000. Seven new beds at Hampton were finished and taken into use in November, 1906. During the year the Board authorized the construction of another six beds at Long Ditton, of a water area of 7¾ acres, together with a supply-tank to be constructed at Ditton. The approximate cost of these works was estimated at £85,000. Tenders have been accepted and the work is in progress. Tenders have also been accepted for the construction of filter-beds at Barn Elms, to increase the filtration area for the district taken over from the West Middlesex Company, at the sum of £15,750 (*plus* £450 should it be found necessary to provide a jetty in connection with the work), and for the provision of the necessary castings. Twelve filter-beds at Kempton Park, with an area of 9 acres, were brought into use during the year. Nineteen new filter-beds of 16·75 additional acreage were brought into use during the year. The total number of filter-beds is 161, or 161·91 total acreage, or 0·85 acre per million gallons average daily supply of filtered water; the latter figure ranging from 0·41 in the New River district to 1·35 in the Grand Junction division. The average monthly rate of filtration per square foot per hour during the year varied from 0·903 gallon in the Grand Junction division to 2·54 gallons through the New River beds.

An interesting table is one giving particulars of the number and capacity of the service reservoirs for filtered water (as distinct from storage reservoirs for raw water) in each district. The total number of service reservoirs is 78, of 243·142 million gallons total capacity. Of these, two only, situated at Hanger Hill, Ealing, of 53 million gallons capacity, are uncovered. In addition to these, reservoirs of 67 million gallons total capacity are in course of construction at Honor Oak, Fortis Green, and Southfleet. In view of the rapid increase of population in the district supplied from the Woolwich Common reservoir, the Board are extending the 18-inch main from Crayford to Plumstead Common as far as this reservoir; the length of the extension being 3000 yards, and the estimated cost £5750. As the only possible means of improving the supply to the high-level parts of Norwood and Croydon (there being no other land available sufficiently high on which a reservoir could be built for the purpose), the Board took a lease for 99 years of one of the two high-level tanks adjoining the Crystal Palace Parade. Negotiations were subsequently entered into for the acquisition of the freehold of the land on which the tank is built; and it was agreed that the Board should pay the sum of £7000 for the freehold of the property. The tank has a capacity of 207,000 gallons, and the top water-level has an altitude of 437 feet.

Another table appended to the report contains a summary of works authorized during the year in the several districts, classified according to the description of the works, and showing the authorized expenditure in respect of each. Certain works for the protection of the Board's New River mains were carried out at the expense of the Middlesex County Council, in accordance with section 34 of the County of Middlesex (Waltham Cross and Enfield) Light Railways Order, 1905, and opportunity has been taken during the construction of these works to proceed with the culverting of the New River at Southbury Road, Enfield.

The New River Company's Act of 1896 authorized the carrying out of certain works of river enlargement in the neighbourhood of the Amwell Marsh and Amwell Hill pumping-stations, for the purpose of remedying a considerable source of leakage (estimated at about one million gallons per day) which was taking place in this particular length of the river by percolation into the chalk. The work had been commenced by the New River Company; but was not completed owing to the imminence of the transfer of the undertaking to the Board. The Board have therefore now authorized the remainder of the work to be put in hand. It comprises the concreting of a length of about 370 yards in the channel of the river, at an estimated cost of £3300, and a length of about 150 yards of river channel opposite the Amwell Hill pumping-station, as well as the reconstruction of the Amwell Hill sluice controlling the river at this point—the estimated cost of the latter part of the work being £1500.

With regard to the distributing system, the total length of mains *in situ* at the end of the year 1906-7 was nearly 6044 miles; including 3 miles of Staines mains. The various diameters are given in a table, which shows that the pipe mostly in use is the 4-inch. The length of new mains laid during the year was upwards of 96 miles. The largest extensions were in the New River and Kent districts—being 29·8 and 20·7 per cent. respectively; while less than a mile was laid in the Chelsea division. The length of new mains laid per additional service varied from 30·4 yards in the Chelsea division to 5·4 yards in the eastern district; the figure for the whole area being 9·3 yards.

The Board possess 91 pumping-stations in all, of which 54 are for wells and 37 are stations other than wells. The number of engines is 257, having a total of 34,645 H.P. There are 130 engine-houses and 512 boilers. These figures are exclusive of the equipment of small auxiliary work. The total quantity of coal burnt during the year was 170,266 tons, equal to 2·07 tons per million gallons of water supplied; each ton representing 482.335 gallons of water supplied. The consumption was lowest in the eastern district—viz., 1·53 tons—compared with 2·81 tons per million gallons supplied in the Lambeth division; that is to say, each ton represented 651,864 gallons supplied in the former case against 356,103 gallons in the latter. In the Kent district, where all the water has to be pumped vertically from the wells, the consumption was 2·54 tons per million gallons supplied. The southern district used 31·982 per cent., and the western district 25·027 per cent., of the total coal consumption.

As bearing closely upon the purity of the water supplied to London, the portion of the report dealing with the sewage schemes in which the Board are concerned, claims attention. Their third annual report contained an explanation of certain contemplated sewage-diversion works in the Lea Valley, and the circumstances which led the Board to withdraw their proposals as contained in their Bill of the session of 1906. In May the Board received a letter from the Local Government Board enclosing a copy of a resolution passed at a conference between representatives of the Hertfordshire County Council and of the Urban and Rural District Councils in the Lea Valley, stating that the various local authorities were prepared to carry out such works for sewage disposal as the Local Government Board might consider to be necessary, and to bear their fair share of the cost, on condition that the Water Board should bear any portion involved in bringing an otherwise good effluent up to the standard which should render the water of the Lea a source quite beyond suspicion of water supply for London. The Local Government Board stated that the question of requiring additional means of purification had arisen in the case of two sewage schemes for places above the East London intake—viz., Sawbridgeworth and Harlow; and the Board desired to be informed whether the Water Board would be prepared to meet the cost of any additional works required in these cases, or to make a contribution towards the cost, and generally what were the Board's views on the question of such contributions. The Local Government Board were informed that, subject to the consideration of special circumstances in any particular case, the general view of the Water Board was that if local authorities efficiently maintained and carried on such works of sewage purification as were usually required by the Local Government Board when sanctioning loans under the Public Health Act, 1875, no additional means of purification would be required so far as the Water Board were concerned.

As mentioned in the third annual report, in accordance with the terms of a lease made between the Corporation of Hertford and the East London Water-Works Company, the Board are, as successors of the Company, responsible for the treatment and purification of the sewage of Hertford. In accordance with the terms of the lease, a scheme for the construction of new works was prepared by the Company, and application was made by the Hertford Corporation to the Local Government Board for sanction to the borrowing of £27,000 for the purpose. During the consideration of the Lea Valley scheme, the question of the construction of the proposed new sewage works at Hertford remained for some time in abeyance. By the New River Company's (Hertford Sewage Diversion) Act, 1854, the sewage must, before being discharged into the Lea, be subjected to "the then best known practicable process" for its purification; and it further provided that, in the event of any question arising as to what process shall be adopted, the Board of Trade may determine the matter by a declaration, and such declaration is to be conclusive until superseded by a subsequent one.

Acting under these powers, the Board of Trade, in May, 1904, declared that "the then best known practicable process" for the purposes of the Act was septic tank treatment, followed by double contact beds and final filtration of the effluent through sand; and plans had been prepared on these lines. In November, 1906, the Water Board asked the Board of Trade to supersede their declaration of May, 1904, by another one prescribing as the best known practicable process for the purification of the Hertford sewage the passing of it through detritus tanks, followed by septic tank treatment and the sending of the resulting effluent through percolation filters.

The Water Board have since received a letter from the Board of Trade suggesting, in view of the fact that the duty placed upon them by the Act of 1854 is now outside their ordinary functions, that provision should be made in the Board's Various Powers Bill to transfer to the Local Government Board their powers and duties under sections 8 and 9 of the Act of 1854 referred to, and enclosing a copy draft clause to which the Local Government Board had given their concurrence. The Law and Parliamentary Committee were therefore instructed to secure the inclusion of the proposed provision in the Board's Various Powers Bill of this year, which received the Royal Assent last Wednesday.

The remainder of the report is devoted to miscellaneous matters, including the settlement of uniform scales of charges for water, reviews of the parliamentary proceedings in the session of 1906, the legal decisions that affect the Board, and some observations (with tabulated results) on the chemical and bacteriological examinations of water.

Another Rise in the Price of Coal.—As the result of a decision come to by operators on the London Coal Exchange, an all-round rise of 2s. per ton took place in the price of coal last Saturday. The main reason assigned for the increase, which is 1s. per ton more than was intended, is the action of the present Government in removing the export duty, which largely increased the foreign demands. In the opinion of many merchants, this is only the beginning of an era of high prices.

THE ILLUMINATING POWER, IN ORDINARY AND INCANDESCENT BURNERS, OF COAL GAS, WATER GAS, AND MIXTURES OF THE TWO GASES.

By M. Emile Sainte-Claire Deville.

[Abridged Translation, with Comments, by W. J. Atkinson Butterfield, M.A., F.I.C., of a Communication presented to the Meeting of the International Photometric Committee in Zurich, July 18 to 20.]

(*Continued from p.* 576.)

Second Memorandum (Dated February 16, 1905).

THE ILLUMINATING POWER IN INCANDESCENT BURNERS OF COAL GAS COMPARED WITH THAT OF WATER GAS AND OF MIXTURES OF THE TWO.

Definitions.—Having measured the absolute intensity (I) of the light of an ordinary incandescent burner at the rate of consumption (G) per hour, the illuminating duty of the burner will be $\frac{I}{G}$, and may be expressed in carcels per 100 litres, or litres per carcel (or, say, candles per cubic foot, or fraction of a cubic foot per candle). If C is the calorific power of the gas used, then $C \times G$ expresses the heat expended in one hour under the mantle, and the ratio $\frac{I}{C \times G}$ will represent the illuminating duty of the heat, which may be expressed in carcels per 1000 calories (or candles per 1000 B.Th.U.). For instance, gas having a calorific power of 5000 calories per cubic metre, when burnt at the rate of 110 litres per hour in an ordinary Welsbach burner, may give an absolute intensity of light of 6 carcels (or, say, gas of 562 B.Th.U. per cubic foot, at the rate of 3·88 cubic feet per hour, may give 58·8-candle power). The illuminating duty of the gas will be 5·45 carcels per 100 litres, or 18·3 litres per carcel (13·75 candles per cubic foot); or 10·9 carcels per 1000 calories, or 91·5 calories per carcel (about 37 B.Th.U. per candle).

Burner with Artificial Air-Supply.—The duty just referred to is that which an ordinary burner affords when it draws its air supply from the atmosphere around it by reason of the joint action of the bunsen injector and the chimney draught. But it matters not by what means the efflux and admixture of gas and air in question have been achieved; and the duty will be the same if the same efflux and admixture are brought about under the same mantle from a burner to which the air is fed artificially. A burner so arranged that the air supplied could be measured just as the gas consumed is measured has been used by the author for the researches of which an account was published four years ago.* Herr Winkler also has made similar measurements of the natural air supply to gas-burners by the aid of his ingenious and elegant method involving the use of a tube with a plug of smoke.† [The plug of cigar smoke is introduced into a wide glass tubulure attached to the side of the vessel through which the air supply which it is desired to measure passes to the burner. The outer end of the tubulure is open, and the plug of smoke therefore remains stationary only if the air supply passing over the other end of the tubulure is at precisely atmospheric pressure. If the air supply is either above or below the atmospheric pressure, flow of air through the tubulure naturally occurs, and the plug of smoke passes with the current of air outwards or inwards. Thus assurance is obtained that the air supply which is being measured is under the normal—*i.e.*, atmospheric—pressure at which the air is supplied to the burner in the ordinary conditions of use. There are obvious objections to the use of cigar smoke in a room in which photometric observations have to be made; and, moreover, the plug of smoke has to be replaced by blowing a fresh supply into the tubulure every time it may happen to have been expelled through a change in the pressure of the air supply causing a flow of air through the tubulure. It may therefore be useful to refer to the fact that Mr. C. Vernon Boys has employed a different indicator, which is free from these objections. It is a modification of a device used nearly twenty years ago by him and two other physicists for indicating the flow of air through a tube, in connection with an investigation which required an indicator of a far higher degree of sensitiveness than is needed for observing the air supply to gas-burners. Their object was the measurement of the heat developed by the ether waves which are now used in spark telegraphy; and that heat was detected and measured through the air current which it produced. At first they availed themselves of the oxide of phosphorus which is continuously produced by the slow oxidation in air of a tiny speck of phosphorus. The oxide falls slowly in the form of a thin white line, which closely follows any movement of the air. But even this indicator was scarcely delicate enough for that investigation, and Mr. Boys then devised one consisting of a light plane mirror suspended eccentrically by a quartz fibre in a cylinder of slightly larger diameter, and balanced by a counterpoise screened from the influence of the air pressure. Any flow of air through the cylinder at once deflected the mirror. A few years ago, he adapted this indicator for use in the tubulure of Winkler's apparatus in place of the plug of cigar smoke, and the translator has been much impressed by the advantages it affords in use over the latter. A half-moon shaped vane of paper or thin card is suspended eccentrically by means of a delicate torsion fibre—*e.g.*, a filament of spun glass—and is balanced by a small lead counterweight. It is suspended in a slightly larger opening in a diaphragm placed across the tubulure, and when unmoved by air currents sets in the plane of the diaphragm so that it nearly fills the opening in the latter. The slightest difference of pressure of the air on the two sides of the diaphragm deflects the vane, and the air flows through the opening. The amount of deflection is roughly a measure of the air-flow. When the air in the tubulure once again becomes still, owing to the air within the apparatus being precisely at atmospheric pressure, the vane returns to its neutral position across the opening, in which position there is no torsion on the fibre. Winkler's apparatus, with this torsion vane indicator, appears to afford by far the most satisfactory means of measuring the air supply under normal conditions to gas-burners; but other arrangements—such as that of M. Sainte-Claire Deville and that used by Mr. Charles Carpenter in his investigation of the Metropolitan Argand-Burner No. 2*—may be convenient in particular cases. The paper in which the use of oxidizing phosphorus and of a balanced vane hung eccentrically by a torsion fibre to indicate the flow of air through a cylinder were first described by Mr. Boys and his two collaborateurs, is to be found in the "Philosophical Magazine" for January, 1891. The idea of using the deflection of an indicator by air-current produced from a very small quantity of heat for detecting the latter, was taken from Dr. Joule.]

By reproducing artificially by means such as those mentioned the conditions of ordinary combustion in a burner, it is in the power of the operator to control and vary both the gas and air supply, and to study the resulting effects.

Variation of Duty with the Supply of Air, the Gas Consumption remaining Constant.—With the gas consumption fixed, it is easy, by turning the tap on the air meter, to adjust the air supply to that which affords the maximum duty, and so to find the ratio of air to gas $\left(\frac{A}{G}\right)$ corresponding to this maximum. The following figures for a small ("Bébé") mantle, Brand A, No. 3, were obtained in December, 1904, with coal gas having a calorific power of 5216 calories per cubic metre (586 B.Th.U. per cubic foot), and requiring 5·471 times its volume of air for complete combustion.

Table III.

Consumption of Gas. Cubic Feet per Hour.	Volumes of Air per Volume of Gas.	Illuminating Duty.	
		Candles per Cubic Foot.	B.Th.U. per Candle.
2·19	2·64 (*a*)	11·4	46·6
,,	3·06 (*b*)	16·2	32·9
,,	4·19 (*c*)	11·4	46·6
4·24	3·62 (*a*)	11·0	48·4
,,	4·73 (*b*)	25·4	20·9
,,	5·98 (*c*)	11·3	47·3
7·77	4·35 (*a*)	19·5	27·4
,,	4·83 (*b*)	24·6	21·6
,,	5·22 (*c*)	20·3	26·3

(*a*) inadequate air supply; (*b*) correct do.; (*c*) excessive do.

Variation of Duty with the Consumption of Gas.—Starting with a relatively low rate of consumption of a particular gas under a particular mantle, and increasing it by stages, while regulating the air supply at each stage to that which affords the maximum yield of light for that rate of gas consumption, it will be found that these maximal yields rise rapidly till they attain, and then maintain for a certain time, an absolute maximum value, and afterwards fall slowly. The corresponding proportions of air increase up to the point of absolute maximum value and beyond that they remain without any change. The limiting value corresponds to about 90 per cent. of the proportion of air theoretically required for the complete combustion of the gas. When the variations of yield so observed are plotted out graphically as functions of the consumption of gas, the curve takes the course shown (with a little rounding off for the sake of clearness) in fig. 1. From A to B, there is a rapid increase in the duty and in the proportion of air; from B to C, the duty is maintained at its absolute maximum—*i.e.*, the light increases in direct proportion to the consumption of gas; and from C to D, the light and the temperature of the mantle continue to increase, but less quickly than the consumption of gas, and consequently the duty falls. From B onwards, there is no increase in the proportion of air.

* See "Journal," Vol. LXXXIII., p. 617.

† This method was described in the "Journal," Vol. LXXXVII., p. 803.

* See "Journal," Vol. XCIV., p. 887, and Vol. XCIX., p. 235.

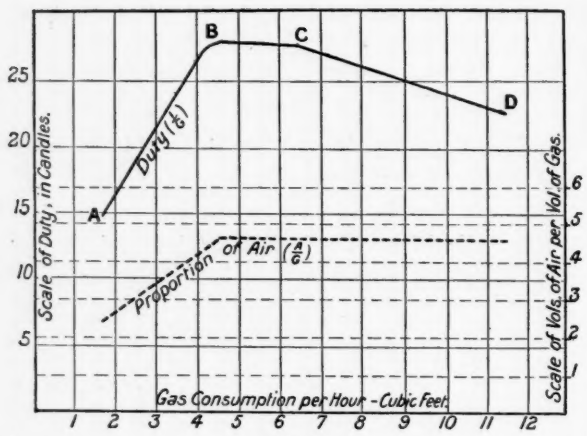


Fig. 1.

Effect of the Size of the Mantle.—The effect of the size of the mantle may be seen from the results of series of tests made with the same gas according to the last-named plan, but using mantles of gradually increasing dimensions, as, for instance—

Mantle.	"Bébé."	No. 1.	No. 2.
Length.	1·97 inches	2·36 inches	2·95 inches
Diameter at top	0·67 ,,	0·67 ,,	0·87 ,,
,, ,, bottom	0·79 ,,	0·91 ,,	1·26 ,,
Surface—vertical projection . .	1·43 sq. in.	1·74 sq. in.	3·10 sq. in.
Cubic contents of interior . . .	0·81 cub. in.	1·16 cub. in.	2·56 cub. in.

The variations in the yield of light as a function of the consumption of gas are governed by laws which will be referred to later; but it will be seen from the curves in fig. 2 for the three

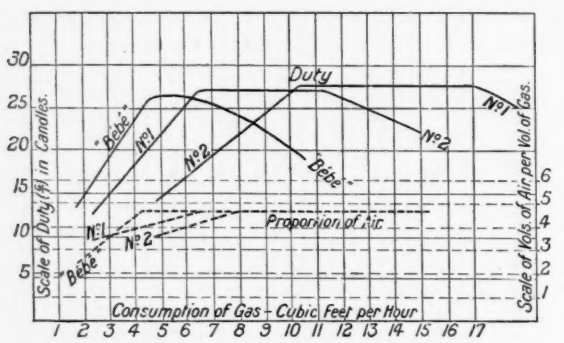


Fig. 2.

mantles of which the dimensions have been given how they become modified with increase in the size of the mantle. The absolute maximum duty augments slightly and is maintained over a greater range of consumption as the size of the mantle is increased. The proportion of air corresponding to the absolute maximum remains the same for all the mantles.

The Specific Illuminating Duty of a Gas.—The foregoing summarized statements indicate that the illuminating duty of a particular gas burnt under the same mantle may vary within wide limits. Consequently, for the comparison of the illuminating duties in incandescent burners of two different gases, it is absolutely essential to define which of the possible duties is to be regarded as the specific duty of the gas. Undoubtedly the maximum duty under a specified mantle should be prescribed as the specific duty, and it could be readily determined by the aid of a burner to which the air supply may be fed artificially. Practically when the burner is judged to be giving its most powerful light without being over-driven or making excessive noise, it will be affording its specific maximum duty, as represented by any ordinate between B and C in fig. 2. But in order that the measurement may always be made under the same conditions, some uniform type of mantle must be employed. Unfortunately, at different times and places, different operators get varying results with two gases supposed to be alike, whatever mantle of specified type and size they may have elected to use. The light will vary in accordance with a number of conditions which it would be very difficult to define; and in the existing state of the mantle industry, the author thinks it will be impossible to establish any specification for the direct determination of the illuminating power of gas in incandescent burners.

Conditions for Comparative Testings.—If, however, the only object is to find the law of variation of the incandescent illuminating duty in relation to the calorific power and the temperature of combustion of the gas, it will suffice to carry out short series of testings. It is possible in one such series to test five or six different gases without changing the mantle, or even extinguishing the flame. The maximum duty per cubic foot or the B.Th.U.'s per candle will be determined in these testings, and the results so obtained for the different gases will be comparable. Each series of testings taken by itself will afford a glimpse of the law of variation of the incandescent illuminating duty of the gases. On bringing together and comparing the results of a number of series of testings, a fairly correct idea can be formed of the effect of the calorific power or of the theoretical temperature of combustion of the gases on the value of the illuminating duty in incandescent burners.

(To be continued.)

GAS FROM STRAW.

An article in a paper with the title of the "Daily News Advertiser," Vancouver, British Columbia, affords an interesting leader under the title of "Making Gas from Straw." The graphic description by the colonial journalists of the marvels of the so-called new invention and of the praiseworthy efforts of the inventor to bring the idea to perfection, are suited to the Provincial Daily Press. There is, however, somewhat of interest—a large amount in our Colonies, and indirectly from a scientific point of view to those at home living in the old country.

Briefly, the question is this: All those interested in the manufacture of gas know that gas in the ordinary sense can be made of any material of an organic nature; but the main consideration is one of economy—viz., whether the ratio of production and profits will supply a necessary margin on a commercial basis. This is the chief issue. There are two points about gas manufacture—the gas which can be used for various purposes, and the worth of the residual products which can be recovered, and possess a certain trade value. This applies to all classes of gases—from coal, peat, lignite, shale, or wood, and all other sources. The old adage says that "circumstances alter cases."

Reverting to the manufacture of gas from straw, cob-corn husks, &c., the conditions are these: In the wheat-growing districts of the Far West, where the circumstances are very different from those which exist in the old country, straw and the husks of maize have been practically waste products. The only available product of commercial value has been the grain, which realizes a variable profit dependent upon market prices. The refuse, straw husks, &c., have been valueless, with the exception that, not being worth cartage, they have been burnt on the land, mainly with the view of getting rid of the surplus rubbish. A certain amount of value has no doubt been gained from this rough process by the restoration to the soil of some proportion of the mineral constituents necessary for the maintenance of a fresh crop.

The new aspect of the case is the utilization of these waste products in another direction—that is, for the production of gas. The statements now put forward are that in the area of Western Canada, and in the wheat-growing districts of America, it is computed that over 200 million tons of refuse products are burnt annually in the fields as waste products. Further, it is estimated that over a ton of these waste products is produced from each acre of land under cultivation. It is also stated that each ton of wheat straw refuse will produce 15,000 to 16,000 cubic feet of gas, against 10,000 feet from a ton of ordinary coal. Enriched with petroleum, this gas is claimed to be equal in value for heating and illuminating purposes to that furnished to the largest cities of America. The matter is of interest, moreover, as it is stated that Beatrice, Nebraska, has a works supplying the new gas, the consumers of which are well satisfied; and that it is proposed to extend the system to other districts in the wheat-growing area. The bye-products are stated to be coke, ammonia, wood alcohol, and acetone.

Monazite Sand and Gravel in Brazil.

The British Consul at Bahia, in his annual report just issued by the Foreign Office, gives some interesting details as to the monazite found there. He says it has lately been discovered that there exist considerable quantities of monazite gravel along the course of the Parahyba River in the interior of the State. The discovery was made by some Brazilians, who secured a concession, and have erected plant for concentrating the gravel at the places where it is found; and it is anticipated that the process, if successful, will have the effect of revolutionizing the trade in monazite. The export of sand from Bahia during the past five years (1902-6) has been as follows: 811 tons, 1862 tons, 2901 tons, 1039 tons, and 945 tons. It will be seen that the output varies much from year to year. As a matter of fact, the collecting of the sand on the exposed sea coast, and the subsequent shipping of it, frequently present many difficulties. Moreover, the amount of monazite existing in the deposit varies very much from time to time; and it would appear to be dependent in a great measure on the kind of weather which happens to prevail. Thus the proportion of sand is always greater after the prevalence of a southerly or of a south-easterly gale than at other times. It would appear from this that the main deposit of the sand in question is situated beneath the sea level, from which position it is dislodged and carried ashore through the action of certain winds and currents. Practically all the monazite sand exported from Bahia goes to Germany.

WESTERN WAYS IN AMERICAN GAS BUSINESS.

By ARCHIBALD S. B. LITTLE (writing from St. Louis, U.S.A.).

AMERICA is the land of promise for those interested in gas-works construction, as new works are being contemplated or are in course of construction, while the increase in consumption is so great in already established businesses that retort-houses, and parts in connection therewith, are being doubled in capacity in quite a number of towns. The question, therefore, arises, How are such extensions to be executed? Let me endeavour to outline the most favoured methods which have appealed to gas engineers during the last 25 years. It may be taken that what was in vogue at the beginning of that period, still has the approval of many engineers; and therefore one may conclude, not without reason, that in America there is still a good deal to learn before gas can be made economically, be sold at (say) 4s. 2d. per 1000 cubic feet, and carry a reasonable profit to the shareholder.

Why this should be so I cannot understand, as there is no limit to the dividend which may be paid. The price of gas is fixed by the company, with little or no let or hindrance on the part of the licensing authority. It follows, therefore, that every reduction in the cost of production is a direct gain to the company. Perhaps it is owing to the fact that gas finds a ready sale at "$1 per 1000," as this means that any sort of system can be applied and still a profit can be made. Or, further, there is no time for the engineer to look around and find new and improved methods. He has all his work to do in keeping pace with new construction on established lines. I will give some idea of what is found over here in a lately-built (I cannot say modern) retort-house.

Horizontal retorts, with hand charging, is the principle most generally adopted; and the beds (always called a "bench" over here, with so many benches to a "stack") are set with from three to nine retorts each. The favourite settings are sixes in an arch measuring 8 feet between the piers; the latter being about 18 inches thick to make the beds 9 ft. 6 in. centres. It is claimed here, in the Middle-West, that the clay is equal to anything in the East or in England; and, so far as shape is concerned, a visit to several factories has convinced me that it would be difficult to find better. But relying solely on information furnished by the makers, when I try to arrive at an opinion as to its durability and capability of withstanding heat or wear and tear, all that is to be said when summed up is that something is wrong either with the clay or the way it is formed and assembled in a bench, or perhaps with the treatment it gets after passing into the hands of gas-works operatives. Benches, down to the regenerators, over here are re-set every two years; and this is considered a good performance. Drawings I have inspected appeal to one favourably in respect to the design of regenerators, except for needless complication in the flues. This is due to the everywhere accepted idea that a long zig-zig travel is required for the secondary air. The outgoing gases travel downward to and fro; and in between the flues a secondary air channel is placed—the junction between the two latter being by way of a vertical tube at the side, which is built into the side wall of the producer (and even in one case it was placed in the main pier, as shown on Sketch No. 4).

Dealing with main piers and arches, the mid-walls are 18 inches thick, and built of 9-inch by 4½-inch by 2½-inch fire-bricks (in this section of the States 3-inch bricks are unknown), while the end pier has a 9-inch wall with 2 ft. 3 in. of stock bricks as a buttress, it being bonded into the fire-brick every fifth course. The main arch is formed of 9-inch by 9-inch by 2½-inch arch bricks; and over this one to two rows of hollow tiles are laid to keep down

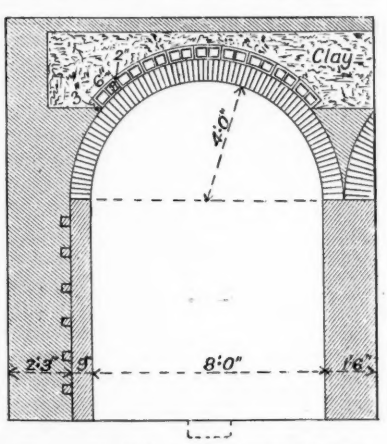


Fig. 1.—The Main Arch of a Retort-Setting.

loss of heat by radiation. Above this is a 6-inch thickness of clay, which also fills in the spandrils; and on this are built two courses of stock bricks. In Sketch No. 1, I have endeavoured to make the description clear. Sometimes a 2-inch air-space also is left between the 9-inch arch bricks and the hollow bricks; it being closed at front and back by the outside walls of the bench.

The ashpit is made of cast iron, and measures 18 inches wide, 6 ft. 3 in. long by 7 in. deep; and a peculiarity of the beds is the action of this portion. In working, the pan is filled with water; and though there is a water supply pipe laid on, this is only put into use on few occasions, so as to fill up the pan as the water evaporates. No continuous stream is used; and there is no overflow pipe. So far, I have not seen how the men get along with the clinkering. It is hardly necessary to say that no steam jets are used on this construction.

As before mentioned, the regenerators are well built of special blocks, and should (and I believe they do) work well. I propose, before concluding, to indicate the general construction when I describe some inclined settings. But before leaving the fire-clay work, I will say that the retorts are generally 9 ft. 3 in. long, with a 1-inch space, and then a 9-inch mid-wall—making the depth of a back-to-back setting 19 ft.5 in. However, back-to-back benches are not often used, as single stacks find most favour. Through retorts are very much disliked, and are seldom used. The retorts themselves are all hand-made, 3 inches thick, with the bottom of the mouthpiece end swelled out and the top thickened internally.

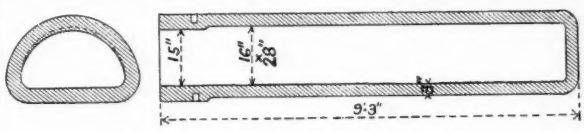


Fig. 2.—An American Retort and Mouthpiece.

This makes the cast-iron mouthpiece smaller than the retort-face, as on Sketch No. 2. The retorts are made very large—sometimes up to 19 inches by 31 inches section.

It is now my intention to describe a trial installation of inclined retorts; and in this you will be able to follow the details of iron-work as used on horizontal retorts also. For all practical purposes, the two are identical; and to describe each separately would call for more space than the "JOURNAL" can spare.

The labour question in all parts of the States is becoming very acute; and in every trade there is great scarcity. When, therefore, a call is made for men to do the hard work in a gas-house, the response is deplorable from the manager's point of view. In some places, as much as 12s. 6d. per day is offered; but when men can get nearly as much for wrecking a building, what hope has the manager of securing a steady supply of suitable stokers? To give some idea of what tradesmen get, I may say that plumbers in St. Louis are paid $6 (25s.) a day. In a number of cases, works have been temporarily shut down owing to the inability of gas-works to find men who will do the shovelling of coal. This can lead only to one way of solving the problem; and that, of course, is the adoption of some system of construction which will require little labour, and that of an easy kind—skilled to a certain degree and not so highly-paid. Power-driven horizontal charging machinery is out of the question, as the works are in most cases small (having an output of from 150,000 to 300,000 cubic feet per day), owing no doubt to the rapidity with which towns come into being—in some cases developing from nothing to quite large proportions, with the rapidity of the proverbial mushroom. One town I recently visited was prairie 16 years ago, and now has a population of 45,000.

What class of engineer or construction, you will ask, is to be found round here, to take hold of this problem? The answer has already been hinted at in the opening portion of this article. However, I will at once say that there are a number of men here who see the need of labour-saving machinery in the gas-works of the country, and are going ahead on the right lines in an effort to overcome the adverse conditions which here and now exist, and that would otherwise cripple the industry. The plan outlined, and which is being followed, is to set up small stacks of inclined retorts. But when the schemes are examined by English eyes, practically the only thing which bears resemblance to known construction is the angle of repose. The details I am about to give show clearly the lines on which engineers are going to work; and as only sketches and outlines are given, it is as well to say this, because complete drawings would uncover to competitors the secret of the system, while they would not appeal to English engineers. The sketches show the latter the broad lines on which this first stack of three beds is being built, and allow them to make comparisons and draw conclusions—thus relieving the writer of the task of criticism or comment.

In beginning, one may make clear the fact that the problem has been approached by builders of successful horizontal retorts, and as no research has been made into past efforts on the part of foreign builders of inclines, it is not strange to find the main features of the bench bear a striking similarity to the horizontal settings. But in the new construction the retorts are inclined at an angle of 32° to the horizon.

As is usual in the Middle West, the foundations are carried only flush with the outside flanges of the buckstays, and the iron stanchions are not built into the concrete as in England; neither are the foot-plates secured to these buckstays to form a bearing. The main piers are 18 inches thick, and the end buttresses are formed of 9-inch firebricks with 2 ft. 3 in. of red brick as on Sketch No. 1. The hollow tiles, clay filling, and double course of red brick are adopted also as for horizontals. The retorts are set four in a bed, and the width through the bench horizontally is 11 ft. 10½ in., thus giving a retort 14 ft. long which it is proposed to charge every four hours with 600 lbs. of Pittsburg coal, calculated to give about 70,000 cubic feet of gas per bed per diem—the actua

amount needed being at the rate of 50,000 cubic feet. I give an idea of the house in cross section (Sketch No. 3), from which it will be seen that the building is only 28 feet wide, giving a 9 feet width on the charging floor and just over 7 feet on the drawing floor. Here let it be noted that excellent ventilation is provided for the summer months, and due protection is afforded for the severe winter ordeal when (as recently) a 4 feet fall of snow is often found and leads to occasional drifts around the retort-house up to 18 feet deep.

The retort-house shown in Sketch No. 3 is 64 feet long, suitable for three beds of fours. It has twelve glazed windows 5 ft. 6 in. by 3 ft., and a louvred top to the roof 50 feet long. The wall on the drawing side has four openings, 8 ft. by 6 ft., provided with rolling steel doors. It is built in one with the condenser house, purifier house, and meter house; a 12-inch wall separating each from the adjoining portions. Strange to say, the purifier house is closed except for a 24-inch star ventilator in the roof. Light is obtained from four glazed windows, which measure 5 ft. 6 in. by 3 ft. There is also one door measuring 6 ft. 6 in. by 3 ft.

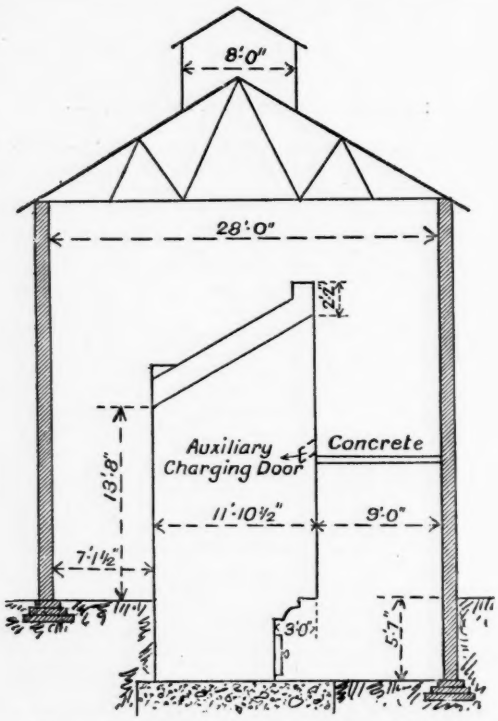


Fig. 3.—Cross Section of an American Retort-House.

As to the details of the regenerators, English engineers will no doubt find a deal of strangeness, and the elaboration of special flues (requiring many difficult and costly blocks), which entail a lot of skilled labour in the laying, making the scheme one that will not appeal to your readers. As I hinted before, the lines of the old horizontal work have been followed; and so long as gas companies are willing to pay for intricate work such as this is, then there is no reason why these costly constructions should not be adhered to after adjustments have been made to render them suitable for inclines. Sketch No. 4 shows the construction of one regenerator and producer, and attention may be called to the unique and perhaps objectionable method of putting flues in the main piers, to connect the secondary air passages.

The system, in ordering from the factory, is to number all the blocks and tiles below the retort level, and to letter all the special blocks for the seating and holding-in of retorts. Hardly an ordinary "square" is used in setting a regenerator; and even in the main piers and the arch covering, a number of specials are adopted to supplement the squares.

I note that the main flue (separate entirely from the bench) is rather small, as the primary air inlets measure 6¾ in. by 7⅛ in., and take six flues in three beds. This gives a total of 293·4 inches. Then the secondary air inlets measure 9 in. by 6 in., giving for the three beds 324 square inches in section. The two together total 617·4 inches.

The combination of air and gas (heated) has to pass through a main flue, 22½ inches by 20 inches, which gives an area of 450 square inches, or less than the combined area of the air inlets where there is no heat.

The charging door measures only 12 in. by 13 in., which seems very small to take the coke from a 14-foot retort with a section of 16 in. by 28 in. The producer goes right through the bed; and the clinkering is done at the back (see Sketch No. 5), where it will also be noticed that there is an auxiliary charging door on the top stage which can be fed with cold coke if it is found better to have a larger supply in the producer.

Over here, a feeling seems to prevail that one cannot have too

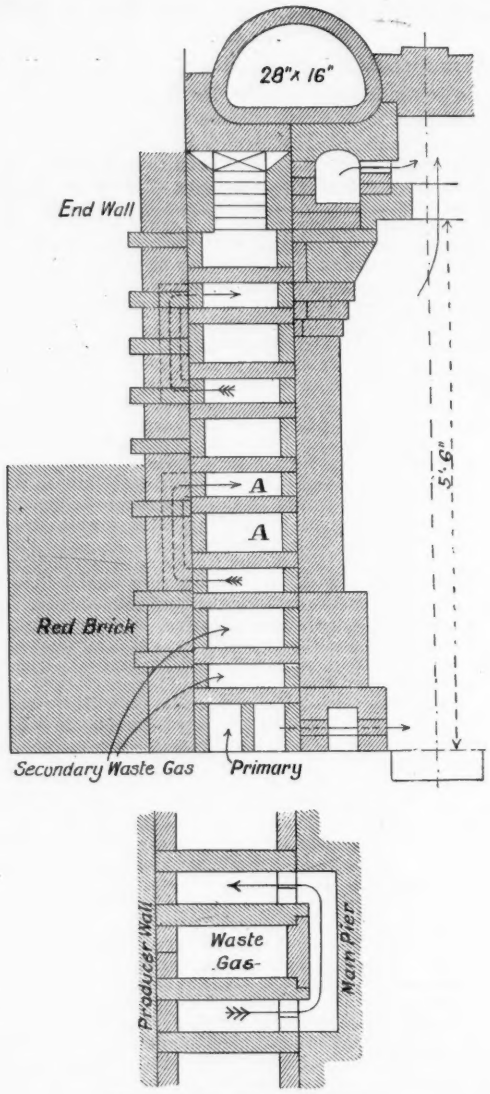


Fig. 4.—A Generator and Producer.

many sight-holes in a bench; and in each bed of these inclines there are 24 of them—14 above the regenerator, and 10 for inspecting the air and waste gas flues, besides 6 unprotected holes where dampers slide in (of which more anon).

Sketch No. 5 gives details of the producer in longitudinal section. From this it will be seen that the bed is one huge kiln with no cross dividing wall, and not even a longitudinal wall to separate the different halves of the regenerator. It remains to be seen how this will work out; but I feel sure that before the stack is completed, alterations will be made to admit of better separate

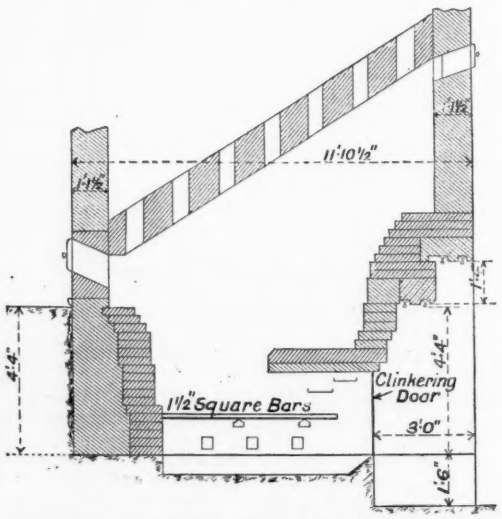


Fig. 5.—Longitudinal Section of the Producer.

control of the gases to each regenerator, and the provision of dampers to control the supply of gas from the producer to the top and bottom sections of the setting.

It is hardly necessary to call attention to the fact that all the gas-nostrils are one size; so there will be a difficulty in ensuring an even supply of heat to the different parts of the setting, owing to the greater pressure in the parts caused by different altitudes. It is suggested now that the holes might be made bigger, and various tiles or blocks be provided to drop into them—the holes in the blocks being larger or smaller as necessity may determine. It is hoped that the draught may be regulated by dampers, which are so set as to divert the pull from the top to a lower section, as shown on Sketch No. 6. But the plain is, I believe, quite a new departure, and only a trial can decide if it will be effective.

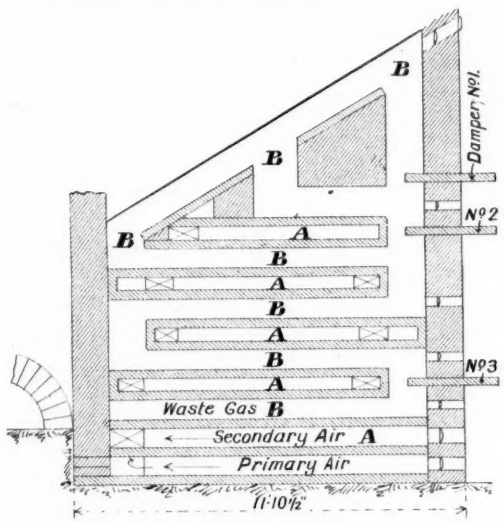


Fig. 6.—The Dampers of the Regenerator.

It will be noticed on the sketch that there are three dampers to each half of the regenerator; and the idea is that by closing No. 1, the gas will be induced to keep clear of the top end of the retorts if the heat is found to be too great there—the flow thus going in the main part to the mid outlet to the waste-gas flues. But if the centre section of retorts is found too highly heated, by partly closing damper No. 2 the major part of the gases will be diverted to the front of the setting. There is no chimney damper; so that damper No. 3 in the regenerator will be used to control the pull in the setting.

I may say that the retorts are supported by cross walls, six in number, built of special interlocking blocks. The width gives a bearing of 6 inches for the retorts; the space being 11 inches between the blocks. This is, I believe, a greater span than one would care to adopt in England.

In a subsequent article I propose to give some details of iron-work, mains, &c.

SULPHURIC ACID IN THE AIR OF TOWNS.

In the "JOURNAL" for the 4th of June, attention was called to a lecture delivered by Professor A. H. Church, F.R.S., at the Royal Institution, on the subject of "The Conservation of Historic Buildings and Frescoes," in the course of which he made some remarks on the injury caused by the presence of sulphuric acid in the air of large towns, and especially of London. The full text of the lecture has now been published, and we extract therefrom the portions dealing with this matter.

There is no doubt that the larger proportion of the sulphur present in coal escapes during burning in the forms of sulphuric and sulphurous acids. Some remains in the ash; and this quantity may be increased by mingling slaked lime with the coal. (Lime water, which has been suggested for this purpose, is far too weak; indeed, 3000 gallons, or 13 tons 8 cwt., would be required to fix the sulphur of 1 ton of coal.) But there is a minor, though by no means negligible, source of sulphuric acid in the products of the combustion of coal gas. Since the restrictions imposed on the London Gas Companies have been relaxed—that is, since Oct. 1, 1905—the sulphuric acid from this source has trebled in amount; the average during the twelve months preceding the relaxation having been 11½ grains per 100 cubic feet, but in the subsequent twelve months 33 grains. I have to thank Dr. Clowes, the Chief Chemist and Superintending Gas Examiner to the London County Council, for his kindness in supplying me with the official figures. And during the present year so far there have been 43 grains in the same volume of gas. The corrosion of copper boilers heated by gas is now so much more rapid that their lives are shortened in the ratio 7 : 2. If sulphuric acid from coal gas, like that from paraffin oil, contributes in a comparatively small degree to the pollution of the general atmosphere of London, it exerts a definitely injurious action when produced in close proximity to an easily affected surface, such as that of a fresco, within a building. No wonder that the delicate film of calcium carbonate, the distinctive binding material in a fresco, will soon perish under the onset of oil of vitriol.

Here let me anticipate what I might have relegated to a later part of my discourse—viz., a few words concerning the best known frescoes in the Palace of Westminster. I do this because the question of sulphur in gas happens to have been brought into close connection with these paintings in consequence of a parliamentary paper published last year. For it has been urged, by one who writes in the interest of the gas companies, that "the hydrochloric and nitric acid vapours resulting from the electric arc lamps in nightly use in London are even more pernicious than the burning of gas as at present manufactured." But it must be remembered that analyses of London air and London rain prove that the proportion of these acids present is quite insignificant compared with that of sulphuric acid. The same writer states that five frescoes in the King's Robing-Room in Westminster Palace have required nothing more than the removal of dirt. This remark is made in order to discount a statement of mine in the parliamentary paper just named. This statement runs thus: "The increased and increasing consumption of coal in London, and the greater licence allowed to the gas companies in the matter of freeing their gas from sulphur compounds, must result in a serious augmentation of sulphuric acid in the air of the Metropolis." But very much more than the removal of dirt was needed. The frescoes are no longer frescoes. While retaining the aspect of frescoes, they have been transformed gradually into paintings which have had their original binding material replaced mainly by ceresin and paraffin wax, unalterable compounds competent to resist even sulphuric acid. But not only has the painted surface required fresh protection, but the ground itself has had to be strengthened by similar treatment; the plaster having been in many places "sulphated" and thus rendered rotten.

And now I turn to another criticism of the already-quoted passage from the latest parliamentary paper on the Westminster frescoes. It will be found in the "JOURNAL OF GAS LIGHTING" for the 21st of August last. The writer, after stating that he is not then disposed to question the opinion that it is sulphuric acid which is the chief destructive agency at work on the Westminster paintings, argues that the greater licence allowed to the gas companies will result in an improvement of the London atmosphere. The line of argument is this: "The use of gas will be extended by the cheapening which the slight increase in the permitted amount of sulphur in the gas involves." In consequence less coal will be burnt; and there will, therefore, be less sulphuric acid produced and thrown into the atmosphere. For it is admitted on all sides that the burning of coal is the prime source of the sulphuric acid in the general atmosphere. Of course, if gas were made at or near collieries, and sent in pipes to the big cities, and displaced coal for heating as well as lighting purposes, we should go far to abolish town smoke, and should greatly lessen the sulphuric acid. Unfortunately for the actual cogency of this argument, we find that the three chief gas companies in the County of London have not reduced the price of their gas in the smallest degree since the relaxation of the rule about sulphur, while their gas has, during the twelve months ending Sept. 30, 1906, discharged into the air three times as much sulphuric acid—and during the last three months (January to March) four times—as it did under the former restrictions. This is, indeed, a retrograde movement.

Manchester District Institution Excursion.

The Sub-Committee to whom were entrusted the arrangements for the August excursion of the Manchester District Institution of Gas Engineers, are to be congratulated on the excellent preparations they made for the trip to Worksop and the Dukeries last Saturday. A long day full of interest was the result; the weather being fine, though not any too bright. On reaching Worksop, light luncheon was served at the Royal Hotel, after which the party drove to Welbeck Abbey, where the hour-and-a-half the programme allowed for the inspection of the house and grounds was all too short for the majority of those present. The drive was then continued to Ollerton; and here an excellently served luncheon awaited the arrival of the party at "The Hop Pole" Hotel—a well-known house which has recently undergone extensive development, and is now replete with every comfort for both occasional visitors and for those able to spend a longer time than was possible on Saturday among the beautiful surroundings of Sherwood Forest. The return journey to Worksop *viâ* Clumber and Thoresby was much enjoyed; and all were ready for the tea provided at the Royal Hotel, Worksop. In the course of the day, opportunity was taken to formally thank the Sub-Committee—Messrs. J. H. Brearley, J. Wilkinson, G. H. Niven, and the Hon. Secretary of the Association (Mr. H. Kendrick)—for their trouble in arranging the day's programme. Needless to say, the President of the Association (Mr. William Prince, of Stoke-on-Trent) busied himself throughout the day in looking after the welfare and enjoyment of the party, which included, as is usual on these excursion meetings, a considerable number of lady friends of the members.

ANALYSIS OF PRODUCER GAS FOR THE POWER ENGINEER.

The current number of the "Chemical News" contains an article on the above subject by Mr. H. Procter Smith, F.C.S.

In the writer's opinion, there is nearly always a gap between the results given by a chemist and the data required by an engineer to act upon the information given. As a rule, this gap can be filled much more easily by the chemist than by the engineer; and if it were filled by the mutual co-operation of the chemist and the engineer, there is no doubt that valuable information would be acquired, and would eventually bring the chemist and the engineer to be recognized as main factors in helping to swell the profits of an industrial concern, and not as at present mere non-producers and a necessary nuisance.

This is illustrated in a very striking manner since the rapid advances which have been made in utilizing producer gas as a motive power in a gas-engine. In this instance, we have a chemist who makes analyses of samples of the gas, and perhaps offers suggestions as to the reason for an increased percentage of carbon dioxide, or of hydrogen, and so forth, and who reports to the engineer the relative quantities of carbon dioxide, carbon monoxide, hydrogen, marsh gas, &c. But, as a rule, this is all.

Now, the engineer knows that he wants a gas with as large an amount of combustible as possible, and he also knows that the gases carbon monoxide, hydrogen, and marsh gas are combustible. But from looking at the mere percentages of these gases he cannot, as a rule, form much idea of the amount of horse power which this gas will develop in his engine; and the factors given below are such as will enable the engineer or the chemist to rapidly convert the gas analysis into a heat analysis, and from that to a power analysis.

The power capable of being developed by a gas is a ratio of its heating value; and this value is in relation to the amounts of its constituent gases. An element when combining with oxygen evolves a certain definite amount of heat, and (if this change is brought about rapidly) also light, when the process is termed "combustion." With the commoner elements—carbon and hydrogen—use is made of this reaction to generate heat; and the elements are termed fuels. Coal is a mineral consisting chiefly of carbon and hydrogen, and may be ignited and burnt in air with the generation of heat. Coal may also be partially burnt in a closed vessel (termed a gas-producer), and converted into gas which may be burnt and converted into power apart from the vessel in which the gas is generated.

The amount of heat so generated is expressed in two chief units: The British thermal unit (B.Th.U.), which is the amount of heat required to raise 1 lb. of water 1° Fahr.; and the kilogramme-calorie, which is the amount of heat required to raise 1 kilogramme of water 1° C.—the water in each case being at its point of maximum density, 39·2° Fahr. or 4° C.

The heating or calorific value of carbon is 14,544 B.Th.U.; that is to say, if 1 lb. of carbon were burnt in oxygen or air, it would generate enough heat to raise 14,544 lbs. of water 1° Fahr.

To consider now the combustible gases. Carbon monoxide has 4386 B.Th.U. per pound; hydrogen, 61,524 B.Th.U.; marsh gas, 24,021 B.Th.U. This is the heat generated from these gases in parts by weight. But, as we generally measure gas, these figures require to be converted into the B.Th.U. or calories which are developed by burning 1 cubic foot or 1 cubic metre of the gas.

Further, in burning all substances containing hydrogen, the combustion produces water; and if, as is generally the case, the final temperature is above 212° Fahr., this water is converted into vapour (steam), and passes off in the waste gases. Now, the conversion of water at 212° Fahr. into steam at 212° Fahr. absorbs a large amount of latent heat, which can only be recovered by condensing the steam. Thus the available calorific value produced by burning hydrogen is lowered; and therefore in all compounds containing hydrogen we have a total and an available calorific value.

The following factors serve to convert hydrogen, carbon monoxide, or marsh gas directly into either B.Th.U. or calories:—

	B.Th.U. per Cubic Foot.		Kilo.-Calories per Cubic Metre.	
	Total.	Available.	Total.	Available.
Carbon monoxide	3·419	3·419	30·43	30·430
Hydrogen	3·473	2·924	30·91	26·026
Marsh gas	11·278	10·133	100·38	90·225

To convert calories per cubic metre into B.Th.U. per cubic foot, multiply by 0·11235; to convert B.Th.U. into calories, multiply by 0·252; to convert calories to B.Th.U., multiply by 3·968. To show how such a calculation may be worked, suppose we have a sample of Mond gas of the following composition:—

	Per Cent.		B.Th.U. per Cubic Foot.	
			Total.	Actual.
Carbon dioxide	12·9		Nil.	Nil.
Carbon monoxide	13·2 ×	3·419	45·14	45·14
Hydrogen	24·8 ×	3·473 or 2·924	86·13	72·51
Marsh gas	2·3 ×	11·278 or 10·133	25·94	23·30
Nitrogen	46·8		Nil.	Nil.
	100·0		157·21	140·95

Thus, by a few very simple calculations it is possible to convert a chemical analysis into a heat analysis.

Then, for power conversion, 1 B.Th.U. = 778 foot-pounds, and 1 H.P. = 33,000 foot-pounds. Thus the theoretical power analysis is merely a matter of proportion.

It must, however, be borne in mind that the theoretical and practical results seldom exceed 25 per cent.; but to the gas-power engineer the calorific power, rather than the chemical analysis of a gas, is what is required.

Utilization of Towns' Refuse for Gas-Making.

The growth of large cities during recent years has rendered more difficult of solution the problem of the disposal of the continually increasing mass of refuse. The only means at present available are tipping the stuff on waste land and leaving it to rot, taking it on barges or by rail to some distant spot or far out to sea, or burning it in a destructor. The last, though undoubtedly the best system, leaves much to be desired, both from a sanitary and a financial point of view. Another method of disposing of refuse has been discovered which, it is claimed, gives much more surplus heat than the destructor, and not only furnishes it in its most convenient form—viz., gas—but also yields valuable residual products in the shape of ammonia, &c. The method referred to is that of the Refuse Converter Company, Limited, of 5, Robert Street, Adelphi, for whom a trial extending over ten hours was carried out at the Barking Gas-Works in May last by Mr. H. A. Humphrey, M.Inst.C.E. We have received a copy of his report, but, for the present, its contents must be regarded as confidential. This, however, may be stated, that Mr. Humphrey considers the system, as applied to existing gas-works of which it is desired to increase the output, has a distinct field of usefulness. The profit arising from working it is reckoned at from 2s. 4d. to 3s. per ton of refuse dealt with, exclusive of the amount obtainable from the local authority for its disposal.

We are asked by the Manager of the Manchester Gas Exhibition (Mr. Walter Cawood) to remind our readers that it will be held from Oct. 23 to Nov. 9. As already intimated, the exhibits will comprise appliances for interior and street lighting; cooking, heating, and ventilation for public and domestic purposes; motive power for industrial uses; and various applications of gas in textile and other factories. Residual products and models of gas plants, with testing apparatus, will be well represented. The Joint Advisory Committee consists of members of the Manchester District Institution and the members of the Society of British Gas Industries; Mr. Thomas Newbigging being the Chairman, and Messrs. H. Kendrick (Stretford) and W. Whatmough (Heywood) the Hon. Secretaries.

By a recent decree of the President of the French Republic, M. Alfred Lebon, General Manager of the Compagnie Centrale d'Eclairage par le Gaz, has been nominated a Chevalier of the Legion of Honour.

We are informed that the Nichtigkeits Abtheilung of the German Patent Office has annulled the Dellwik water gas patent No. 105,511. The case will, in due course, be definitely settled by the Reichsgericht.

Sir Alexander B. W. Kennedy, the President of the Institution of Civil Engineers, will perform the opening ceremony in connection with the forthcoming Engineering and Machinery Exhibition at Olympia, on Thursday, the 19th inst. He will be supported by Sir William H. White, last year's President, and a number of other leading men in the scientific world.

The death occurred on the 25th ult., in his 88th year, of Mr. Thomas Bugden, who for upwards of half-a-century had carried on business as an india-rubber manufacturer in the Goswell Road, and was one of the best-known men in the trade. The event calls for notice in our columns from the fact that deceased was the original maker of gas-bags for use in repairing mains, and was consequently in close touch with the distribution of gas. The funeral took place at the Islington Cemetery, Finchley, last Thursday, and was largely attended.

We learn that, in view of the coming season, the "Star" Inverted Incandescent Burner Company, Limited, have improved their burner by altering the shape of the renewable porcelain nozzle, which is now so designed that, as the tip becomes worn by the heat, the light of the mantle increases, whereas in the older form deterioration was attended by a slightly diminished illumination. An alteration has been made in the mantle-carrier, with the view of minimizing deposits; and the air-tubes—a patented feature of the burner—are now controlled by shutters at two inlets instead of only one as formerly. In conjunction with these improvements, a somewhat heavier metal is being used this year for the burner, with which an improved non-sticking bye-pass nipple, with lever and chains, or a single lever with an insulating knob, can be supplied. The Company have also effected improvements in their mantles to increase their durability.

ILLUMINATION PHOTOMETERS AND THEIR USE.

By PRESTON S. MILLAR.

[A Paper read before the Illuminating Engineering Society at their Boston Meeting.]

In this discussion, instruments which measure the chemical or calorific effects of lights are not considered. The illuminating engineer is concerned more particularly with instruments designed to aid the eye in determining the illuminating effect of light. These may be classified broadly as photometers dependent upon visual acuity, and those in which the illumination to be studied is compared to that produced by a standard light source.

Visual Acuity Photometers.—The principle of visual acuity, as generally applied, depends upon the detection of the vanishing-point of an effect produced by the light to be studied. In some cases it is the disappearance of a figure or character; in others, the disappearance of a contrast. Such instruments, being based on the ability of the eye to see or distinguish objects, yield results which are proportional more nearly to those qualities of light which make for visibility than to its intensity. They are known as visual acuity photometers, or illuminometers. There are fundamental difficulties with this extinction method which render it unsuitable for important work. These are: The inability of the eye to judge with precision of the point of disappearance; the susceptibility of the eye to the influence of environments and conditions; the necessity for reducing the light to low intensities at which the "Purkinje effect" operates to distort results; and the errors encountered in effecting this reduction. The decided advantages which this method can boast are simplicity, absence of expensive adjuncts, and a minimum demand for technical knowledge and skill on the part of observers.

Illumination Photometers.—The only photometers which may be relied upon in engineering work to yield reliable values are those in which a comparison light source is used, and reliance is placed upon the ability of the eye to judge equality of illumination. The essential features of such photometers are: (1) A photometric device; (2) a comparison light source; (3) a means of varying the intensity of the illumination produced on the photometric device by the comparison light source; (4) a test-plate on which the unknown light falls.

Photometric Devices.—These may be divided into three groups: (1) Arrangements of prisms whereby surfaces illuminated by the comparison and the test light sources may be viewed in one field with an indistinguishable line of separation. Such devices are characterized by maximum sensibility and ease of comparison, but are generally difficult and expensive of construction. Particularly with low intensities they are superior, working with fair sensibility on intensities quite below the range of other devices. The Lummer-Brodhun photometer is a notable example of devices of this kind. (2) Screens of varying translucency; the opposite sides being illuminated by the comparison and test sources respectively, and being viewed through prisms or mirrors in contiguous fields. The Bunsen photometer is the well-known example of this class of photometric devices. Various adaptations of the Bunsen photometer are used very largely in photometric work in America. In general, they fall but little short of the prismatic devices of the first class in respect to sensibility and ease of comparison, and are simple and inexpensive of construction. (3) The various devices whereby the illumination intensities produced by the comparison and test-light sources respectively are viewed in contiguous fields with a well-marked line of separation. In this class may be found the Bouguer screen, the Ritchie wedge, the translucent blocks of Elster and Joly, and other means of comparing illumination intensities, all of which are simple and inexpensive of construction, but lack in sensibility and ease of comparison.

Other photometric devices will be found described in text-books on photometry; but they do not merit serious consideration at this time—in most instances failing to equal those described in point of accuracy, reliability, or simplicity. Of these, the flicker photometer is noteworthy. The difficulty in manipulating it, and its inapplicability to electric lighting by alternating current, make it unsuitable for use in illumination photometers.

Comparison Light Sources.—These are found in great variety in photometrical work. They may be classified broadly as flame sources and incandescent electric lamps. Among the flame sources, two deserve special mention. The pentane lamp—the legal standard of light in Great Britain—is used largely by gas companies in laboratory practice as a primary standard of light. The Hefner amyl-acetate lamp, the legal standard of light in Germany, is used largely there as a primary standard of light, and somewhat in America in both laboratory and portable photometers. In addition, kerosene, benzine, and gas-burners have been used in photometers as secondary standards of light.

The pentane and Hefner lamps as primary light standards give results of considerable precision when used in the laboratory, under carefully controlled conditions, and manipulated by those who are expert in their use. In common with the other flame sources used as secondary standards in portable photometers, but little in the way of precision and reliability can be expected. They are all so dependent upon uniform conditions of burning as to be unreliable when used where they are moved about the room, or where they are liable to changes in atmospheric conditions and in draughts. The fire risk which they entail is a strong objection to their use. The only place which they should have in the measurement of illumination is in connection with photometric apparatus which lays no claim to high precision, and in which simplicity of construction, absence of measuring instruments, and source of energy supply, constitute an advantage which overbalances the superior accuracy obtainable with the incandescent electric lamp properly used. Such a field flame sources undoubtedly fill—offering a means of determination much superior to that obtainable with photometers based upon the visual acuity method.

With the incandescent lamp used as a secondary standard of candle power, most favourable photometric conditions may be obtained. Its use, however, necessitates a source of current supply and a means of determining with fair precision the voltage at which it burns or the current it consumes. Under these conditions, it may be relied upon to remain constant for a limited period, during which time it constitutes the most reliable, accurate, and satisfactory comparison light source.

Means of Varying the Intensity of Illumination Produced upon the Photometric Device by the Comparison Light Source.—This has been accomplished by a variety of methods, some of considerable ingenuity. These may be classified as follows: (1) Variation in distance, applying the inverse-square law; (2) rotating discs, relying upon Talbot's law; (3) inclination of an illuminated surface, applying Lambert's law of the cosine; (4) variation of the intensity of the comparison light source; (5) the use of absorbing media; (6) the use of variable diaphragms, generally with diffusing screens; (7) dispersion lenses; (8) polarization method. Of these, the variable distance method is, in the opinion of the writer, superior, in that it possesses accuracy, reliability, ease of verification, calibration according to a known law, simplicity, a wide range, and universal applicability. No other one method possesses all these advantages.

The properties of the rotating sectored disc have been investigated on a number of occasions, perhaps most recently by Dr. E. P. Hyde.* This is an excellent means of varying the intensity of light, but lacks somewhat in simplicity where it alone is relied upon. It is possible that, under some conditions, errors might be introduced by this method when applied to alternating current electric lighting, and to some other forms of lighting in which periodical flickering phenomena are encountered.

The variation of the inclination of a plane with reference to the light incident upon it, or to the angle at which it is viewed, is an unsatisfactory method—first, because unless a perfect diffusing surface is obtained, the cosine law will not apply, and the instrument should be calibrated empirically; secondly, because any surface which approximates a perfect diffusing surface is likely to change in character, which would introduce an error into the scale calibration of the instrument; and, thirdly, because the scale calibration of an instrument in which this is used becomes very narrow with low intensities, so that the slightest displacement of the plane will produce a marked difference in the illumination in the region where the photometric comparison is rendered difficult because of the low intensity which is being studied.

Two methods of varying the intensity of the comparison light source have been used. In one, adjustable opaque screens expose a greater or less portion of the luminous body—a method particularly applicable when flame comparison sources are used. The other method consists in varying the intensity of the source itself—with flame sources, by some wick adjustment; and with electric lamps, by varying the current flow. This method is unsuitable for use with flame sources, because it is necessary to wait some time after an adjustment is made before a constant luminous intensity is obtained. With electric lamps it is objectionable, because the satisfactory range throughout which the method may be applied is of necessity small, since with very low intensities the colour value becomes altogether objectionable, and with higher intensities the lamp must be operated at so high an efficiency as to endanger its constancy.

Absorbing media offer an excellent and very practicable means of varying the light intensity; but they must be selected carefully in order to guard against errors due to selective absorption. Properly selected, they form an excellent adjunct to a photometric system. If, however, they have any marked tendency towards selective absorption, they must be used very intelligently, or errors will be introduced. While it is possible to construct absorbing screens which may constitute a complete device for varying the intensity, this method has found its best application in varying the intensity by large steps where supplementary means are provided for effecting finer variations. The comments in this paragraph apply as well to the use of absorbing screens with variable diaphragms.

Dispersion and polarization methods are but little used in America in photometry of the class now under discussion. The writer has had no experience with these methods; but since obviously superior and more practicable means are available, they would seem to merit but little consideration.

The Test-Plate.—In general work, the intensity of the light incident upon a given surface is the only quantity which it is practicable or even desirable to measure. This is not proportional necessarily to the illuminating effect, which varies as well with the point from which the surface is viewed, with the colour of the light, and with the colour and character of the surface. The

* An interesting paper, read before the Illuminating Engineering Society by Dr. Hyde, was given last week (p. 576).—ED. J. G. L.

criterion by which the light intensity is judged must be strictly proportional to the light incident upon the test-plate, and must be independent of each of the other improper variables just mentioned, if the results of the observation are to show the intensity of the light incident upon the surface.

Whether or not the light falling upon the photometric device varies only with that incident upon the test-plate depends upon the design and location of the plate. Consequently there is no feature of an illumination photometer more deserving of the attention of its designer. But, strange to say. in this particular many instruments are badly designed and liable to large error.

The requirements for a theoretically correct test-plate are: (1) A plane white surface which, when viewed from the point of photometric observation, obeys Lambert's law of the cosines with reference to intensity of illumination produced by light incident upon its surface at any inclination and from any direction; (2) a material which will not introduce errors due to colour differences; (3) a plate which may be placed at any angle; (4) a location such that neither the body of the observer nor parts of the instrument shall obstruct light falling on the plate.

The character of the surface upon which the effect is studied naturally influences the results materially. If it were to consist of a mirror in which practically all the reflection is regular, the value assigned to any light incident upon its surface would vary from *nil* to 100 per cent., depending upon whether it was viewed from a point within or outside the field of regular reflection. If the surface were glazed, light incident upon it at angles of sharp inclination would suffer or profit unduly through regular reflection; the nature of the effect depending upon the point from which the surface is viewed. Hence it is necessary to secure a plane surface which shall be as nearly as possible a perfect diffuser of light, in order that light incident upon it at any angle may be credited with its true intensity, and only its true intensity. Unfortunately, there is no available surface which accurately meets these requirements. Therefore, in selecting a surface, the requirements must be kept in view as an ideal, and must be approximated as closely as may be practicable.

Until it shall be found possible to use a true diffusing surface, results must vary with the direction from which the test-plate is viewed, unless it is studied by reflected light from a point directly above the centre of the plate, or by transmitted light from a point directly beneath the centre. The first is obviously impossible, because it would necessitate interference with light which would otherwise fall upon the test-plate. It follows, therefore, that the correct method is to consider transmitted light from a point directly beneath the plate.

It is, of course, desirable to measure all the light which would be incident upon an object at the point to be considered. In all interior lighting systems there is more or less diffused light, all of which has some illuminating value. In order to measure all the effective light, there must be no objective interference with light incident upon the plate at any angle. This means that all parts of the instrument, as well as the observer, must be beneath or behind the surface of the test-plate. This is possible only when transmitted light, instead of reflected light, is measured.

The illuminating effect of any lighting installation may be a function of the horizontal, vertical, or normal illumination produced; while a study of the illumination produced upon surfaces otherwise inclined affords data of value and interest to any investigation. The necessity for providing simple means for placing the test-plate at any desired angle is therefore apparent.

The introduction of differences in colour values complicates photometry seriously. If the light from the mercury vapour lamp were to be studied upon a red surface, its illuminating effect would be no criterion of the light intensity. Hence the only colour which is practicable is white, of as great purity as may be obtainable, and as free as possible from selective absorption. With such a test-plate, lights of different colours are credited with approximately their true intensities, when the test-plate is viewed from the photometric device.

The Ideal Photometer.—It appears, therefore, that in constructing a photometer the designer has a choice of many photometric devices, comparison light sources, and means of varying the light intensity and effecting the photometric comparison. With respect to the test-plate there should be no choice. It should have a plane white diffusing surface; it should be translucent, and viewed from directly beneath its centre it should be capable of location at any angle; and it should be so located that all parts of the instrument and also the observer are beneath or behind it.

In the ideal photometer, such a test-plate would be found combined with the most sensitive photometric device, the most reliable comparison light source, and the best means of varying the intensity. These features should receive first consideration, for reasonable precision ought to be the first *desideratum*. Next in importance come portability, simplicity of operation, and reasonable cost.

As there is an insistent demand for an illumination photometer which shall be both reasonably accurate and thoroughly practicable, it is felt that a discussion of the instruments which have been designed with this in view will be of interest to members of the Society. In the following paragraphs will be found brief illustrated descriptions of eleven photometers; but only the essential features of each are touched upon. The diagrams are all lettered similarly, in order to facilitate comparison. Thus A indicates the test-plate, B the photometric device, C the comparison lamp, and D the means of varying the intensity.

Beckstein Illumination Photometer.—Fig. 1 is a plan of the photometer. The test-plate A is placed at the point where it is desired to study the illumination. This plate may be rotated throughout a vertical plane about the photometric device as an axis. B is a Lummer-Brodhun cube, through which the lower surface of the test-plate is viewed from H. Through the prisms may be viewed

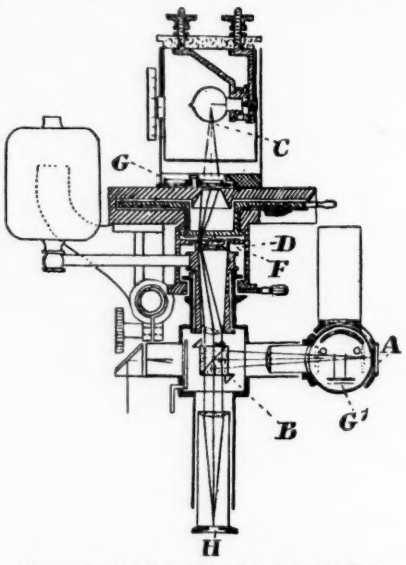


Fig. 1.—Beckstein's Photometer (Sector Type).

also the translucent plate G, which is illuminated by the comparison lamp C. Equality of illumination is obtained by viewing the plate through a portion of the lenses F which may be rotated. At the position D is placed a variable sector disc, about the axis of which the beam of light is rotated by the lenses. The result of the photometric setting is obtained from the size of the opening of the sector disc D, which is necessary in order to obtain equality of illumination. This device is a rotating sector disc, except that the beam of light instead of the sector is rotated.

Beckstein (Weber) Illumination Photometer.—This photometer, of which fig. 2 is a plan, is a modification of the Weber photometer, and is simpler in construction and less costly than the instrument described in the preceding paragraph. The test-plate and prism arrangement are similar; but the comparison lamp C is a benzene lamp, and equality of illumination is obtained by

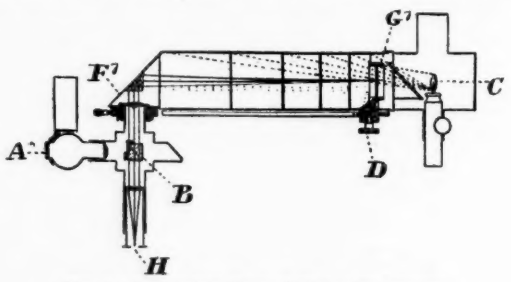


Fig. 2.—Beckstein's Form of Weber Photometer.

movement of the translucent screen G, by means of the rack-and-pinion device D, along a tube; its intensity of illumination varying as the square of the distance from the lamp. The results of the photometric settings are read off directly from a scale along the tube through which the plate G' travels.

Blondel and Broca's Illumination Photometer.—Fig. 3 is a plan of this photometer. The portion of the light which is transmitted

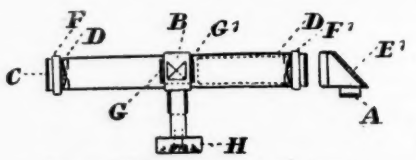


Fig. 3.—Blondel and Broca's Photometer.

through the test-plate A is reflected from the 45° mirror E' through the lens F' upon the ground-glass plate G' (which forms part of the photometric device). Before the lens F' is placed the "cat's-eye" diaphragm D'. A comparison light source C, which is not described, is placed to the left of the apparatus. Its light passes through the lens F, and falls on the ground glass G. This is varied in intensity by the adjustable "cat's-eye" diaphragm D. The photometric device B consists of crossed prisms through which the ground-glass plates G and G' are viewed from the binocular arrangement H. Equality of illumination is produced by

adjustment of the variable diaphragms D and D′, which are equipped with means for indicating the size of the aperture.

Burnett Illuminating Power Photometer.—A vertical section of this photometer is shown in fig. 4. The light to be studied falls on the test-plate A, which is one surface of a photometric wedge. The other surface is illuminated by the lamp C, which travels along the horizontal axis of the box. This lamp is moved by means of a handle D, which protrudes through the side of the box.

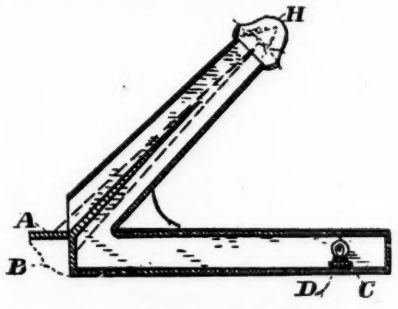


Fig. 4.—Burnett's Photometer.

The two surfaces of the wedge which constitutes the photometric device B are viewed from position H through a box divided by a partition which constitutes a well-defined line of separation between the two surfaces of the wedge. The results are indicated on a scale along the horizontal box, which is calibrated directly in foot-candles.

Marshall's "Luminometer."—The arrangement of this instrument is shown in fig. 5. The test-plate A is also the upper surface of the photometric device B. This consists of a screen of which the translucency is varied by different thicknesses of paper. It is illuminated from beneath by the comparison electric lamp C, the intensity of the light of which is varied by means of the rheostat D. The lamp C is operated from two dry cells within the instrument—a spring switch being placed in the circuit, so that the lamp is operated for a minimum time only. To effect a photometric setting, the flow of current through the lamp C is varied

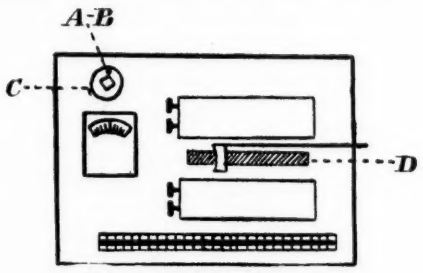


Fig. 5.—Marshall's Photometer.

until disappearance of contrast is obtained at the screen B when viewed from above at an angle of about 45° to its surface. The resistance of the lamp is then measured by means of a simple Wheatstone bridge with a portable galvanometer, both enclosed within the instrument. One arm of this bridge consists of an exposed wire, stretched taut. Beneath this wire is placed a millimetre scale. The contact is moved along the exposed wire until the point of no deflection is obtained, and the foot-candles value is then obtained from the scale reading through an interpretation curve.

Martens' Illumination Photometer.—Fig. 6 shows a vertical

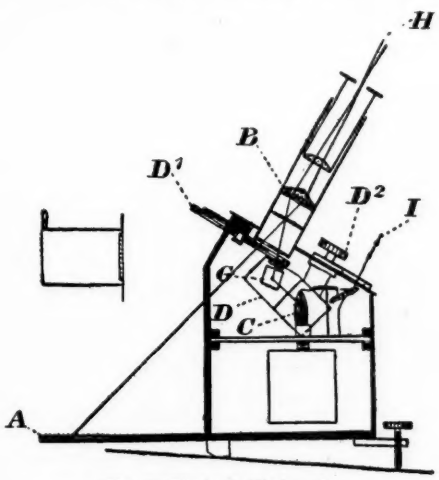


Fig. 6.—Marten's Photometer.

section through the instrument. The test-plate A, which receives the light to be studied, is observed through the photometric device B, through which may be seen also the surface of the plate G, which is illuminated by the comparison benzene lamp C through a pair of sliding mirrors D. These vary the distance between the lamp and the plate; being operated from the rack-and-pinion device D^2. The results are read directly from a scale over which plays a pointer attached to D^2.

Modified Design of the Mascart Photometer.—In fig. 7 the light to be studied falls upon translucent paper A, which constitutes

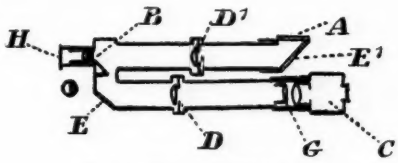


Fig. 7.—Mascart's Photometer.

the test-plate. That which is transmitted passes through the 45° mirror E′, a convex lens, and falls upon the upper half of the translucent screen B. A comparison lamp C illuminates the translucent screen G. Light which is transmitted through this screen passes through a convex lens, the 45° mirror E, the total reflecting prism immediately above E, and falls upon the lower part of the screen B, where it is viewed from H. Both lenses mentioned have adjustable diaphragms D and D′, which are used to vary the intensity and effect equality of illumination upon the screen. The adjustment of these diaphragms indicates the result of the photometric settings. The lamp C is a flat-flame gasoline one. The instrument is standardized by a Carcel lamp, the light of which falls upon the test-plate.

Preece and Trotter's Photometer.—Fig. 8 is a vertical section through this instrument. The light to be studied falls upon the

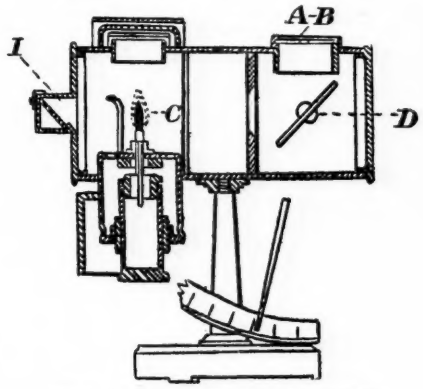


Fig. 8.—Preece and Trotter's Photometer.

surface A, which is also a portion of the photometric device B. The comparison lamp C illuminates a Bristol board D, which may be inclined at any desired angle. Through slits in the surface, portions of the screen D may be viewed. The photometric balance is made by equalizing the brightness of the surfaces A and D.

Ryan's "Candle-Foot" Photometer.—In fig. 9, which shows the instrument designed by Mr. W. D'A. Ryan, the light to be studied

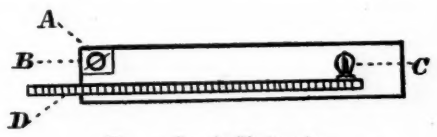


Fig. 9.—Ryan's Photometer.

falls at A upon one surface of the photometric device B, which consists of a translucent block divided diagonally by a thin opaque film. The comparison electric lamp C illuminates the other half of the block. The distance between this lamp and the block is varied by means of a rod D, on which is calibrated a scale indicating the results of photometric settings. The device B is viewed through the side; equal portions of the two halves of the block being viewed.

The Weber Photometer.—In this photometer, which is shown in fig. 10, the light to be studied is received upon the portable test-plate A, which consists of white cardboard. This is viewed from the eye-piece H through a simple Lummer-Brodhun cube B. The light from the comparison benzene lamp C illuminates a travelling translucent screen G, which is viewed from the eye-piece H through B. A unique feature is the use of coloured glasses in the ocular tube with a view to comparing illuminants of different colour values with respect to those qualities upon which depends the ability of the eye to perceive objects which they illuminate. As

has been stated, this is not necessarily proportional to the intensity of illumination.

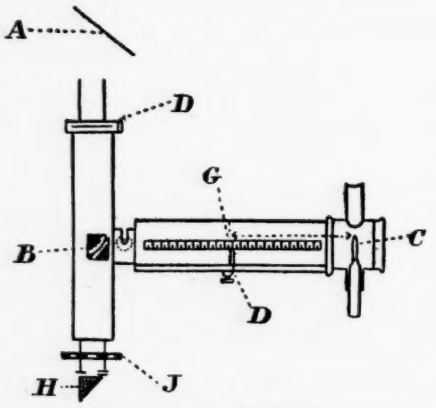


Fig. 10.—Weber's Photometer.

The Weber photometer is now made in a more portable form, and with some modifications. Fig. 11 is a vertical section of this instrument. The test-plate A bears a fixed relation to the photometric device B; but it may be placed at any angle in a vertical

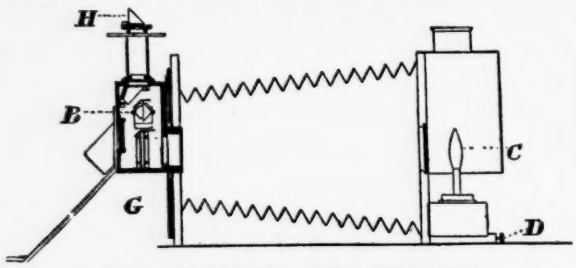


Fig. 11.—Portable Form of Weber Photometer.

plane—the photometric device moving with it around the horizontal axis of the comparison Hefner lamp. Equality of illumination is obtained by moving the lamp C along the photometric axis. Results appear in terms of a unit of illumination intensity. The range is increased by means of absorbing screens.

The accompanying table shows the character of the essential features of each of the photometers described:—

Photometer.	Photometric Device.	Comparison Source.	Variable by which Setting is Made.	Test-Plate.				Method of Use.
				May be Placed.	Colour.	View Point.	Location with Reference to Instrument Parts.	
Beckstein—								
Sector type	High sensibility.	Electric lamp.	Sectored disc.	At any angle.	White.	Correct.	Correct.	Not stated.
Weber type	High sensibility.	Benzene lamp.	Distance.	,, ,,	,,	,,	,,	,,
Blondel-Broca		Not described.	Diaphragms.	,, ,,	,,	,,	,,	
Burnett	Low ,,	Electric lamp.	Distance.	,, ,,	,,	Incorrect.	Incorrect.	Substitution.
Marshall	Low ,,	,, ,,	Current.	Horizontally.	Pinkish white.	,,	Correct.	Direct comparison.
Martens	High ,,	Benzene lamp.	Distance.	,,	White.	,,	Incorrect.	
Mascart (modified)		Not described.	Diaphragms.	At any angle.	,,	Correct.	Correct.	Substitution.
Preece-Trotter	Low ,,	Amyl-acetate lamp.	Inclined surface.	Horizontally.	,,	Incorrect.	,,	
Ryan	Low ,,	Electric lamp.	Distance.	Horizontally or vertically.	,,	,,	,,	
Weber	High ,,	Benzene lamp.	,,	At any angle.	,,	,,	Incorrect.	
Weber (portable)	High ,,	Amyl-acetate lamp.	,,	,, ,,	,,	,,	,,	Direct comparison.

A study of this table will show that no one of the instruments conforms in all particulars to the requirements for an illumination photometer. For example, the Martens photometer incorporates many good features; but its designer has largely destroyed its usefulness by giving the test-plate an impossible location where the measurement of the total illumination produced in any diffused lighting system is entirely out of the question, because the instrument itself obstructs so much of the light.

It was hoped a number of the instruments could be obtained for investigation, but some of them are more or less in the experimental stage, and their designers were not in a position to offer them for this purpose. However, two of the instruments were tested. The results obtained illustrate the extent of errors which may be encountered in measuring illumination with instruments which are incorrectly designed. As respects the sensibility of the photometric device, it was found from repeated settings with one of the instruments in which the device is of low sensibility, that no higher accuracy than 6 per cent. could be obtained. The maximum variations in settings with this instrument were 15 per cent. below and 10 per cent. above the average. It was found that in one of the instruments in which a flame source was used, readings could not be relied upon within 5 per cent. because of flame variations due to draughts, changes in humidity, &c.

In measuring diffuse illumination, where much of the light comes from the ceiling and walls, it was found that with two of the instruments in which the design and location of the test-plate were incorrect, results were obtained which were too low by 20 and 29 per cent. respectively. This was due to regular reflection and obstruction of light by the body of the observer or by parts of the instrument. With the same instruments, change from a black coat to a light coat on the observer introduced differences amounting to 10 and 18 per cent. The extent of these errors illustrates the necessity for careful design and location of the test-plate. It is hardly worth while making a photometer which is liable to errors of this character, in addition to any others which may be entailed by the use of improper comparison light sources, low-sensibility photometric arrangements, and errors in varying the intensity of the light from the comparison light sources.*

As an illustration of the possibilities of errors entailed by reliance upon the direct-comparison method in which a standard lamp is used directly in comparison with the test source, it was found that with one of the instruments seven skilled observers (who, however, were not familiar with the particular instrument under test) obtained values which varied from 21 per cent. below to 34 per cent. above the value which was considered to be representative—viz., the mean result of the seven observers. The average variations of these observers from such mean was 13 per cent.

While it is unlikely that there should be incorporated in any one instrument all the bad features referred to, yet all the photometers mentioned fail to meet theoretical requirements in one or more particulars. The errors found in some of the models are, therefore, shown in the following table for reference:—

	Per Cent.
Photometric device of low sensibility	6 to 10
Flame source as comparison lamp	3 ,, 5
Direct-comparison method, neglecting personal equation	13 ,, 34
Improper design and location of test-plate when measuring diffuse illumination	20 ,, 39

Use of Illumination Photometers.—In the measurement of illumination, either of two general methods may be followed. The first is the direct-comparison method, in which a primary standard of light is employed, or a secondary standard of light is used as a primary standard, so far as the instrument is concerned. The Hefner lamp more than any other light source is used in this way. Or an incandescent electric lamp may be standardized to yield a certain candle power, and may be used, as is the Hefner lamp, for direct-comparison purposes. Such a light source is located at a definite distance from the photometric device, and is calculated to produce a fixed intensity upon that device. This method has the great advantage that it permits an instrument to be more nearly self-contained, and to be used without reference to any other light sources. However, it is liable to serious objections in that all changes in reflecting surfaces or transmitting screens or changes in the comparison lamp, as well as any misplacements of parts, are likely to introduce errors for which no compensation is made. Furthermore, the method makes no allowance for the personal equation. The second, and superior, method is commonly known as the substitution method. This covers a multitude of photometric sins. Here the comparison light is strictly secondary, and is standardized and verified from time to time by other standards of light so placed as to produce upon the test-plate illumination of known intensity. By this method, changes which would introduce errors where the direct-comparison method is used are compensated for entirely or in part, since every effect which they produce upon the

* Generally speaking, European instruments, as illustrated in the Beckstein, Blondel and Broca, Martens, Mascart, Preece-Trotter, and Weber photometers differ from American instruments as designed by Burnett, Marshall, and Ryan, in that they are designed more particularly with regard to theoretical requirements than with regard to the utmost simplicity of operation and lowest cost. Many of the European instruments are relatively complicated; being combinations of a large number of parts, many of which would appear to the American mind as unnecessary.—P. S. M.

measurement of light from a test-lamp will be proportional to the effects produced on measurements of unknown intensities.

It is very important that instruments used in measuring light from any illuminants should be calibrated with reference to light of known intensity from illuminants of similar character. It must be recognized that in many cases this is not practicable. Where it cannot be done, and particularly where the colour values or characteristics of the light are widely different from those of the light sources with which the instrument was standardized, the possibility of error should be recognized.

An excellent method of determining the precision of the photometric part of an illumination photometer is to use it in the photometry of single light sources. The instrument designed specifically for the measurement of illumination differs from the laboratory instrument used to measure candle power only in that it is equipped with an illumination test-plate, and is generally rendered portable, and so enclosed that it may be employed in a brightly lighted room. Any illumination photometer may be used in a determination of the candle power of light sources, if the proper precautions are taken. The light sources and the test-plate of the instrument should be so screened that no light except the direct rays from the source under test reaches the plate. In using an illumination photometer in this way, many large sources of error which attend the measurement of total illumination, are eliminated; and it is possible to learn more definitely the degree of precision obtainable with the instrument used as a simple photometer.

One of the great difficulties in the practical use of an illumination photometer is to be found in the variability of light intensity in most commercial installations. If the installation consists of incandescent electric lamps, this can be dealt with best by operating the comparison electric lamp from the lighting circuit, when its variation will be similar in character, if not in degree, to that of the illumination to be studied. This is known as the "similar circuit method." When an instrument is so designed that this cannot be done, or when the lighting installation consists of other than incandescent electric lamps, it is advisable to continue observations at each test-point over a sufficient period to afford a fair average result.

With any of the photometers described in this paper, it is probable that the skilled photometrist could approximately correct results; for he would locate the sources of error, determine their extent, and apply such corrections as were possible. Most errors in photometry are occasioned by failure to recognize the limitations of the instrument used. Recently there has been exhibited a tendency to forget that photometry is a science, and that one may become skilled in its practice only after he has acquired a knowledge of the fundamental principles involved, and has become experienced in the application of these principles. Instruments have been designed which apparently make so little demand for technical skill on the part of the observer as to give rise to the belief that photometry is as simple as is their operation. This has led to the publication of results which would appear to be utterly unreliable, judging from the instruments and methods employed in making the tests.

It is submitted that this Society, and illuminating engineers in general, must rigidly uphold the best traditions of the past in photometry, and must so apply recently acquired knowledge and experience that a still higher standard may be established. As the photometry of light sources and of illumination has an important place in illuminating engineering practice, we should oppose strongly the recent tendency which has already led to aspersions upon the accuracy of illumination measurements, and which, if followed, must surely bring illumination photometry into disrepute.

In closing, a few maxims are offered, which the illuminating engineer would do well to bring to bear upon photometric problems:—

An instrument must be a good photometer before it can be a good illumination photometer.

Measurement of illumination is more difficult than measurement of candle power.

In obtaining a photometric setting, one does not necessarily determine the value of the light studied.

Every photometer is to be regarded with suspicion until its accuracy is demonstrated. It is then to be regarded with suspicion until it is shown that no change has occurred since its verification.

No photometric information is better than misleading photometric information.

The London and Southern District Junior Gas Association will hold the opening meeting of the forthcoming session at the Cripplegate Institute, Golden Lane, E.C., on Friday, the 11th prox. Subsequent meetings will take place on the second Friday in each month during the session.

The Prospect of Dustless Roads.—At the present time, it is possible for a motor-car to run for 100 consecutive miles in Kent on roads which have been treated with tar; but, according to reports received from local authorities, there is every reason to believe, says the "Daily Express," that 10,000 miles out of a total of 20,000 miles, of main roads in England and Wales will be dustless in the summer of 1908.

GAS FIRING OF POTTERS' KILNS.

At a recent meeting of the English China Manufacturers' Association, Mr. Arthur Woolley, of Longton, gave some interesting particulars with regard to experiments which he has made in firing kilns and ovens with gas—a subject to which reference has already been made in the pages of the "JOURNAL."

Dealing first with the kind of gas to be used, Mr. Woolley said that, in his opinion, Mond gas was not suitable for the requirements of pottery manufacturers. They needed a gas with a highly luminous flame, so bright that it must almost be like electric light. The more luminous the flame, the more perfect the gas for potters' ovens. He did not think there was any difficulty in applying gas firing to kilns; in fact, it was easy to use it with the ordinary or travelling kiln. The difficulty in applying gas firing to ovens had been that in an oven there was a large space of dead matter which had to be fired; and whether coal or gas was used, it required the same heating properties to get through this. Gas was of no more value than coal for getting through a mass suddenly; therefore the chief thing was to have perfect radiation. He had been working on this matter for several years; and it was now an absolutely assured success from almost every point of view—economy of fuel, preservation of brickwork, purity of colour, general cleanliness, and an almost total absence of smoke, if properly managed. He had received valuable assistance in his experiments from Mr. Fell, of Longton. In conjunction with Mr. Fell, he had made various experiments, and had secured a temperature equal to that necessary for the making of steel—namely, 2000° C. The highest temperature required for a bisque oven was from 1350° to 1400° C.; and this could be easily attained by gas, and much quicker than by present firing methods. He believed the gas-firing process could be applied to existing ovens without any expensive alterations. All that was required was to take out the mouths, and in their places put producers. The conditions were exactly the same all the way through, with this great recommendation—that, with care and attention, they were absolutely constant. So far as glost ovens were concerned, the matter was beyond the experimental stage; and, as regarded bisque ovens, for 10, 15, or 20 hours they could have hot air, devoid of flame, passing through the oven, gradually drying the ware and heating the oven. Afterwards, they could introduce the gas-flame, increasing the temperature as needed, or keeping a constant heat. They could either keep a certain temperature for 10 to 20 hours, or they could increase it at will. As producers were placed in each mouth, if, by oversight or carelessness, any part of an oven was firing too quickly, that part could be shut off for the time being without interfering with the process of firing in another part. There had been invented and patented a system for regulating the middle by an arrangement which completely shut out, if required, any gas from passing up the middle, but still firing the outsides, or *vice versâ;* and by this system, they could either enlarge or reduce the well-hole. He did not say they had perfected the process; indeed, he felt they were simply on the fringe of it. As to the cost, he believed they would be able to place on the market an arrangement within the reach of every manufacturer. He did not care how old or what construction an oven was, it could be adapted to work as successfully as one specially built. The advantages were many. He suggested there would be a saving in fuel of 50 per cent.; a saving of 30 per cent. in the period of firing; and a reduction of 95 per cent. in smoke; and, as regarded the firing of the ware, he thought he could safely say they would get a better oven after gas than coal. In his experiments, he had reached perfection with both colours and gold. He regretted they had not some organization which would take up a matter of this kind, and carry out the experiments, instead of leaving them to individual firms.

COST OF PUMPING BY VARIOUS METHODS.

In a paper contributed to the Water-Works, Gas-Works, and Sewerage Section of the recent Engineering Conference, Mr. CHARLES HAWKSLEY and Mr. HENRY DAVEY dealt with the comparative cost of pumping by steam, internal combustion engines, and electricity, based upon actual working.

They said: To compare the cost of pumping by steam, internal combustion engines, and electricity is difficult for want of sufficient comparable examples. The thermal efficiency of the prime mover may be very high, and its consumption of fuel per work done also high, because of mechanical losses. The real economy is the sum of the thermal and mechanical efficiencies in work done. It is only on this basis that a true comparison can be made. The commercial costs are not dependent on the fuel costs alone, but also on other working expenses and maintenance. For public water supply, the drainage of mines and land, and certain other purposes, the power required is generally considerable and continuous; and it is to these applications that we propose to direct attention. In such operations, the cost of fuel per pump horse power (P.H.P.) is the most important item.

The two important questions in pumping operations are cost of fuel and continuous working. Pumping-engines have sometimes

to run for many months without stopping, and should maintain their efficiency for some thirty to forty years with little outlay on repairs. Since the days of Newcomen, no steam-engine has been more economical than the low-speed pumping-engine. The best water-works and mining engines of to-day give one P.H.P. per hour with 12 lbs. to 20 lbs. of steam, depending on the nature of the engine and its application.

The mechanical efficiency of the steam-engine and pump combined varies from 80 to 86 per cent. The steam consumption is 10·5 lbs. to 16 lbs. per indicated-horse-power hour; being as low as that of any high-speed or other steam-engine used to produce electric current. The comparison, then, of a steam pumping-engine with electric pumping plant as regards fuel becomes reduced to a question of the comparative mechanical efficiencies of the two systems, expressed in terms of P.H.P., thus—

Direct-acting steam pumping-engines and pumps—		
Mechanical efficiency per P.H.P.	83	per cent.
Electric—		
Engine and dynamo, mechanical efficiency .	85	,, ,,
Cables, mechanical efficiency	95	,, ,,
Motor ,, ,, ...	80	,, ,,
Gearing and pumps, mechanical efficiency .	75	,, ,, *
Total mechanical efficiency per P.H.P. .	48·45	,, ,, *

The relative fuel economy in the above example is as 10 : 17 in favour of direct steam pumping.

It would appear that establishment charges and maintenance would be greater with electric plant. Electric current might, however, be supplied from a public source. We must then assume the cost per unit. The actual cost at the Neasden Station of the Metropolitan Railway is said to be as low as 0·3d. per unit—not charging repairs or interest on capital. We know of no public supply as low as 0·5d. per unit, but will adopt this figure. Taking the efficiencies given above of the cables, motor, and gearing and pumps only, 1·31 electrical units would be required per P.H.P. This at 0·5d. per unit would represent £24 per P.H.P. per annum for electrical energy alone. The cost of coal varies with the situation; but, generally speaking, in an ordinary steam-pumping establishment, it does not exceed £5 to £8 per P.H.P. per annum [see following table], or less than one-quarter of the cost of electricity at ½d. per unit.

Water-Works Pumping-Engines.

—	Engines Working both Well and Distribution Pumps, thus Pumping the Water Twice.			Engines with Distribution Pumps only.		
	A.	B.	C.	D.	E.	F.
(*a*) . .	485	563	483	370	205	93
(*b*) . .	144	125	178	125	91·5	72
(*c*) . .	100	60	60	70	130	140
(*d*) . .	8/5	7/5	8/1	9/3	9/8	8/1
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
(*e*) . .	7 1 0	7 7 0	7 7 3½	8 12 6	6 9 0	5 2 4
(*f*) . .	12 16 6	12 5 10	11 4 5½	13 9 8	19 13 10	15 13 3

Notes.—(*a*) Total height of lift, in feet. (*b*) Average P.H.P., taken over the whole year (8760 hours). (*c*) Boiler pressure in pounds per square inch. (*d*) Price of coal per ton delivered in boiler-house yard; the coal used being local slack. (*e*) Actual annual cost of coal per P.H.P. (8760 hours). (*f*) Total actual annual cost of coal, stores, oil, wages, and repairs per P.H.P.

We have a record of the total working cost of a not very modern coal-mine pumping-engine, and the average cost of fuel for ten years' continuous working has been £5 6s. 10d. per P.H.P. per annum. During the ten years, the engine has averaged 264 P.H.P. continuously. At ½d. per unit, electricity would have cost £24 per annum per P.H.P. In the same district—a colliery one—the charge for electrical energy is ¾d. per unit, supplied from an electric power supply station. It thus appears that electric pumping plant cannot be economical in fuel, as compared with steam pumping-engines of moderate economy.

Gas-engines, having a higher heat efficiency than steam-engines, naturally have an advantage in fuel economy, all other things being equal. With gas-engines of (say) 200 H.P., the consumption of bituminous coal is, taking the engine-maker's estimate, 1·75 lbs. per B.H.P. The total capital outlay on engines and producers for 1000 B.H.P. is practically the same as that for compound condensing engines and boilers of similar power.

For driving machinery direct, there appears from the above figures to be an economy in fuel alone in a gas-engine over a steam-engine; but for pumping purposes the mechanical loss in gearing between the engine and pumps would probably more than counterbalance the apparent saving. Assuming the mechanical efficiency of the gearing and pumps to be 70 per cent., then the 1·75 lbs. per B.H.P. would become 2·5 lbs. per P.H.P. There would also remain to be considered the reliability of the plant in continuous working, lubricants, and other details.

Looking at the question of consumption of fuel from a thermal-efficiency point of view, and making a comparison, we have—

	Per Cent.
Mechanical efficiency of direct-acting steam-engine and pumps combined	83
Mechanical efficiency of gas-engine alone	80
,, ,, ,, gearing and pumps	70
,, ,, ,, gas-engine and pumps combined .	56
Heat efficiency of steam-engine, say.	15
,, ,, ,, gas-engine	25

* These are variable quantities, depending on the nature of the gearing and the speed at which the pumps may be driven.

The total efficiencies are then—

	Per Cent.
Steam-engine and pumps combined	12·45
Gas ,, ,, ,, ...	14·00

There remain to be considered the relative cost of coal, the additional cost of lubricating oil for the gas-engine, and also the cost of maintenance and reliability in continuous working. In regard to oil-engines, we know of no examples that compete with such plant as we have been considering. These engines generally require, under usual conditions, about 1 lb. of oil per B.H.P.

Discussion.

Mr. Charles Hawksley, who read the paper, stated that Mr. Henry Davey had done the hard work; and, though they were both responsible for it, to him the credit was really due for the "note," which was only intended to start a discussion. It was very difficult to make fair comparisons between different motors, because so much depended upon the situation—the proximity of the coal fields—and the amount of work done. There must mostly be a man in attendance; and he could not be cut up so as to become a decimal part, to correspond with the work done by the engine. One engine might do a hundred times as much work as another, and require no more manual attention. All these things had to be taken into account before a really fair comparison could be made. Then, again, gas and oil engines were undergoing great improvements, which would no doubt increase their economy; while in a great many places the use of electricity was dictated, not by motives of economy, but rather by the convenience with which it could be applied to certain kinds of work.

Dr. G. F. Deacon (the Chairman of the day) suggested that those who had had experience with smaller units with gas and other fuel should relate the results. The paper dealt mainly with slow-running engines, though a comparison was made with gas-engines. The capital cost was entirely left out; and this made a material difference in some cases.

Mr. Noble Anderson remarked that his experience had been chiefly acquired in Australia and New Zealand. As to the paper, it was obvious that when such a short time was allotted to so vast a subject, it was only the fringe that could be touched; and from the different aspects of the matter, it might appear that the views of one man were diametrically opposed to those of another, when a fuller explanation would show that they were absolutely in agreement. He supposed they all had a bias in favour of old friends; and the direct-acting pumping-engine was, he imagined, the oldest friend in the world of mechanical engineering. They were all familiar with it; and they liked what they were familiar with. There were some pumping-engines erected by the Melbourne Metropolitan Board of Works which gave, roughly speaking, a duty of 150 million foot-pounds of work per 1000 lbs. of steam. When, however, he came to design engines for pumping sewage at Dunedin, it struck him that the conditions there would be better met by a centrifugal pump. Those on the market were all rather low in efficiency; and so he looked round for the best, and obtained a pair of Diesel engines to work his pumps. The results secured were, he thought, better than any previously recorded for similar pumping installations. The guarantee was 1 B.H.P. per hour for 0·4 lb. of oil of 19,000 B.Th.U.; and if a better result was obtained, the Company were to have a bonus. The test occupied a month; and the Company secured a small bonus. He thought this would show that oil-engines had made a very great advance within the last few years. The Diesel oil-engine gave a thermal efficiency of 40 per cent., instead of the 24 or 25 per cent. credited to ordinary gas-engines. The installation of two 150 I.H.P. engines, with the centrifugal pumps, and all the valves, &c., was landed in the Colony and erected for a little over £6000; and the prices there were, roughly speaking, about 50 per cent. in advance of those ruling in this country. The plant only required one attendant. The cost of oil was 7d. per gallon. Electricity, so far as his experience went, could not compare with steam.

Mr. Baldwin Latham thought there was very little difference between the cost of producing power with suction gas and by the Diesel engine. There were, however, difficulties with suction gas. Of course, the question of economy depended upon the expense to which people would go to secure an efficient engine. It would pay many authorities in this country, owing to the advance in steam pumping-engines, to take out their old machinery and put down new.

Mr. Charles Sparks, referring to the drainage of mines, said that for electricity he thought the total mechanical efficiency per pump horse power would be 58 to 60 per cent., rather than the 48·45 per cent. given in the paper, though the latter figure might apply to surface work. In his mind, ½d. per unit was altogether an outside figure for the class of pumping he referred to.

Mr. Dugald Clerk remarked that his experience had been confined to pumping plants driven by relatively small gas-engines. Commercially, these engines were limited to sizes of 100-horse power or under. The gas-engine, so far as large sizes were concerned, was still in the experimental stage; and he did not think it could fairly compare with the highly-developed steam-engine of to-day with regard, for instance, to one of the requirements laid down in the paper—that it should maintain its efficiency for thirty or forty years without any great outlay in repairs. At the same time, the large gas-engine was developing very rapidly; and the problems to be solved were all clearly present in the minds of the engineers occupied with this work. In a very few years, they would have large engines as reliable and efficient as the small

ones. At present, they gave a high thermal efficiency; but the reliability, all competent gas engineers were prepared to admit, was not equal to that of the smaller sizes. With regard to cost of suction gas plant, his firm (the National Gas-Engine Company) had many small-power engines at work; and they had nothing to quarrel with in regard to the combined efficiency given by the authors of the paper—*i.e.*, this being taken with reference to horse power of water actually pumped. It was quite common to have a combined efficiency of 14 per cent. for small pumping engines, of (say) 20 H.P. Some of the figures given in the paper were somewhat under-estimated. The heat efficiency of a gas-engine was given as 25 per cent.; but no good modern gas-engine would be so low as that.

Mr. DAVEY pointed out that this was comparable with the 15 per cent. of the steam-engine; whereas the latter might, of course, be 20 per cent. The two figures must be taken together.

Mr. DUGALD CLERK (continuing) said he might state what had been the latest experience as to the absolute efficiency of a gas-engine. In an engine of 50 B.H.P., one expected—and always obtained—something like 35 per cent. absolute thermal efficiency; and many tests had shown as high as 38 per cent. In connection with the Institution of Civil Engineers Committee on Thermal Standards (of which he had the honour to be a member) the indicated efficiency of a gas-engine having a 14-inch cylinder was roughly 35 per cent. This figure, if compared with the steam-engine, would come out much higher than given in the paper. It was not accurate, however, to say that this represented the combined efficiency of suction plant and engine. The thermal efficiency of a good suction gas plant, maintained at full load, was about 86 per cent.—that was, 86 per cent. of the heat contained in the fuel was given to the engine as gas—so that if they took 29 or 30 per cent., they would have the combined efficiency of the engine and producer.

Dr. EDWARD HOPKINSON said, with regard to the statement in the paper that with gas-engines of (say) 200 H.P. the consumption of bituminous coal was 1·75 lbs. per B.H.P., he thought the figure would be more nearly accurate if it was put at 1·25 lbs. He hoped the authors would look into their figure, and see their way to correct it. He agreed with what Mr. Dugald Clerk had said with regard to the heat efficiency of the gas-engine being put too low. He was afraid that Mr. Davey's remark—that the figures were comparative only, and that the efficiency of steam and gas were both somewhat low—would hardly make the comparisons in the paper quite fair. Taking the 35 per cent. given by Mr. Dugald Clerk, the advantage would lie considerably more with the gas-engine than was shown by the authors. In making comparisons between electricity and steam, it was not fair to include the loss in cables. The proper method was to leave this out entirely.

Mr. A. H. MEYSEY-THOMPSON, alluding to Mr. Noble Anderson's remarks, said it would be rather interesting to have some figures regarding the cost of repairs in the oil-engine installation.

Mr. F. R. PHIPPS remarked that, as a municipal water engineer who had had some opportunity of using suction gas plant, he thought perhaps the figures he had been able to obtain might be useful. The installation put down was capable of pumping 40,000 gallons per hour—two-thirds to a low-level reservoir at a height of 75 feet, and the remaining one-third to a high-level reservoir at a height of 180 feet. The water was lifted in two stages. The total efficiency was 65 per cent. Anthracite down South was rather expensive—30s. per ton; and the quantity consumed per pump horse power was 1·19 lbs., costing 0·19d. This was calculated over six months; the engine running 11 hours a day, and the fire being kept going the other 13 hours, ready for blowing up. At Worcester, he had had an opportunity of getting figures as to electrical pumping. There were two sets of single-phase alternating electric motors, pumping 10,000 gallons an hour 300 feet, in one lift. The current was practically the same as that given in the paper—1·31 units per pump-horse-power-hour; and they could not get it at less than 1¾d. per unit. The cost thus came out to 2·3d. per pump-horse-power-hour, which it would, of course, be impossible to pay except when the money was going to another Committee of the same Council. To compete with a steam-engine just put down, it would be necessary to have the current at 0·45d.

Mr. WALTER HUNTER said that his partner Mr. Middleton, if he had been present, would have been able to give them some statistics with regard to pumping by a small gas-engine. The duty was extraordinarily high. Giving his own experience, he referred to a triple expansion steam pumping-engine at Hampton, the cost of fuel for which, he said, bringing everything down to the authors' basis of calculation, would come out at about £5 17s. per pump horse power per annum, which nearly corresponded with one of the results obtained by the authors.

Mr. LLEWELLYN ATKINSON said he was surprised at the Metropolitan Railway Company's figure 0·3d. per unit for electricity, leaving repairs out of consideration. He was certain some plants could produce it at 0·2d., or very little over, for a 24-hour load. Therefore this would be a fair figure for a user who was going to take electricity from his own plant, without reckoning for profit or anything of that kind.

Mr. H. A. HUMPHREY said he would like to give some definite figures relating to cases in which gas power had lately been substituted for steam power in the South Staffordshire district. At one particular pumping-station, he was going to suggest that the cost had been reduced by this substitution—he was speaking of the fuel cost only—to one-quarter of what it previously was. Looking at the paper, the figure of 56 per cent. mechanical efficiency given for the gas-engine and pumps combined, certainly seemed to him to be one in which there was great room for improvement. He was associated in work some time ago with Sir Frederick Bramwell, who suggested that there ought to be a better means of utilizing gas for pumping, and one that would give a higher efficiency. Sir Frederick asked him if he would think it over. He had no time to do so then; but recently he had given the matter his attention, and had designed a pump of an entirely different kind, in which the explosion took place immediately in contact with the water. This pump had no piston, no fly-wheel, no crank-shaft, and none of the ordinary things that appertained to a pump, as they knew it, for water.

Mr. HAWKSLEY asked whether it could be used for potable water.

Mr. HUMPHREY replied that it could. The gas need not come into contact with the actual water delivered, though it came into contact with the layer of water above that.

Mr. THOMAS DUNCANSON said that his experience of water-works pumping-engines confirmed very closely the figures in the table given by the authors. He referred to several deep-well pumping-engines, the cost of fuel for which came to about £7 per pump horse power per annum; while if they were worked 24 hours a day no doubt there would be a higher efficiency. If the engines in use were of fairly decent economy, there would be no great advantage in sweeping them away and substituting other machinery, because the extra interest on the expenditure would counteract the saving from the higher efficiency. He had had no experience with gas-engines; but he should think if one were fitting in new plant, gas or electricity should possess advantages.

Mr. W. BINNIE quoted a suction-gas installation the figures of which, he said, were very low. There were three gas-engines; each unit being 16·4 pump horse power. The coal bill—burning anthracite—was 20 lbs. per hour for six months—that was, 1·22 lbs. per pump horse power.

Mr. GEORGE GORE said he had, from material in his possession, worked out a typical example of a Diesel engine and centrifugal pump. He took a 200 pump-horse-power engine, a consumption of 0·4 lb. of oil per brake horse power, 80 per cent. efficiency for the pump, and 55s. per ton as the cost of oil. The cost per pump horse power per year of 8760 hours worked out at £5 7s. 6d.

Mr. Davey was not present to reply to the remarks that had been made.

REGISTER OF PATENTS.

Rendering Incandescent Gas-Burners Self-Lighting.

COXHEAD, G., of East Ham, Essex.

No. 18,601; Aug. 20, 1906.

In accordance with this invention, a series of burners, or any of the series, may, says the patentee, be lighted or extinguished from one point at will, by applying a catalyst—such as finely-divided platinum black—to the fork or suspension rod of the mantle "at a conveniently close position to the gas outlet of the burner, to be readily acted upon by the flowing gas when turned on, so as to cause ignition upon the gas coming in contact with the catalyst."

Lighting and Extinguishing Distant Gas-Burners.

BARTLETT, F. G., of Bristol.

No. 21,521; Sept. 29, 1906.

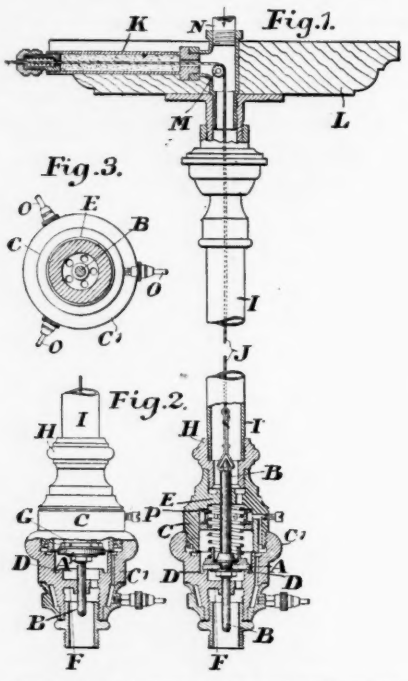
This invention relates to gas-lighting apparatus where pilot lights are used and where a spring-controlled valve is lifted, and held off its seat, from a distance by a cable and tumbler or other switch.

Fig. 1 is a section (see next page) illustrating the invention as applied to a three-light gasalier—the valve which controls the supply of gas to the branches and main burners being shown closed. Fig. 2 is a view of the valve casing and valve—partly in section and partly in elevation—shown open. Fig. 3 is a sectional plan.

The valve A, with its spindle B, is contained within a casing which consists of an upper part C and an under part C^1, into which the upper part is screwed. The valve seat D is circular; and on it rests, when the valve is closed, an india-rubber washer. In the upper part of the casing is a diaphragm E, through the centre of which the valve-spindle B passes. In the diaphragm are apertures arranged in circular series. In the lower part of the casing is a similar diaphragm F, with apertures arranged similarly to the apertures in the upper diaphragm. Between the under face of the diaphragm E and the valve is a spring G in compression, which tends constantly to hold the valve down on its seat. Screwed into the upper part of the casing is an adapter H, into which is screwed a tubular rod I, by which gas is supplied from the ordinary piping. Into the rod is passed a wire or cable J, which has a swivel connection to the valve-spindle B, so that the wire or cable cannot twist. The cable is led through a gas-tight stuffing box K placed in or near the ceiling block L; a pulley M being provided to conduct the cable round the angle. The cable has free play when moving outwards or inwards. The part of the cable which runs on the pulley is preferably a length of chain, and the part in the stuffing box is preferably a rod.

Under the diaphragm E is a ring P, backed by a tape or by cotton wool, through which gas can readily pass. The ring has apertures for the pilot-light gas to pass through to the space behind the ring in the upper part of the casing.

The wire J extends back from the valve to any point in a room, where it may be connected to a "switch" or a straining and retaining device of the usual tumbler or other type.



Bartlett's Gas-Burner Lighter and Extinguisher.

While the valve A is down on its seat D, no gas can pass out of the casing to the branches of the gasalier, and so to the main burners—the valve cuts off the gas supply thereto. But when it is required to light up the main burners, the wire is pulled upon by a strain exerted at the switch, and is retained thereby, and the valve is raised off its seat against the resistance of the spring G, which becomes further compressed between the valve and the underface of the diaphragm E. The upper part of the valve is channelled to form lateral openings or ways for the gas to pass freely out over the valve-disc in event of the spring being so tightly compressed as to allow insufficient gas to pass between its convolutions. When the cable is released from retention by the switch, the spring rebounds and closes the valve, and the main burners are extinguished.

Producing Gas and its Bye-Products from Coal and Similar Substances.

FRITZ, F., of Lauderdale Mansions, W.

No. 20,359; Sept. 13, 1906.

The object of this invention is "to obtain the greatest possible yield from gas-producing substances, which, being submitted to a glow heat, are brought in contact with water, and thereby water gas is formed, which mixes without further process with the distillation gas, so without expense producing a greater yield of gas. Should the water be blown in with air, then the nitrogen contained therein would be secured, and thereby a large yield of ammonia obtained."

The *modus operandi* is thus described by the patentee: The coal, peat, or similar substances under treatment are conducted through continuously working retorts, by means of a chain or other suitable apparatus, and are distilled. At the close of the distillation the glowing coke falls into a retort (which may be disposed vertically), and is there extinguished by a spray of finely atomized water, which, when the object is to produce ammonia, is forced in by air pressure. As soon as the finely atomized water touches the glowing coke, it is transformed into steam. The steam thus passing through the glowing coke is then transformed into water gas; and if the operation is conducted with air-blowers, the oxygen of the air will be utilized for increasing the heat of the coke, and the nitrogen of the air to increase the production of ammonia.

He further remarks: "Through this operation, of using finely atomized water, it is better capable of extracting the ammonia from coke than if the water is brought over the glowing coke or the glowing coke falling in the water, by which latter means the heated coke is immediately quenched, and consequently less steam is produced for the necessary extraction of ammonia. By using air for forcing in the water, the heat of the glowing coke lasts longer by blowing the air on the heated coke."

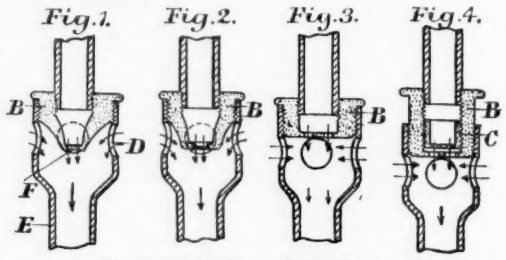
Inverted Gas-Burners.

MANNESMANN, O., of Remscheid, Germany.

No. 27,374; Dec. 1, 1906.

In this inverted gas-burner the air for combustion is previously heated by a special arrangement so that the bottom plate of the nozzle, which is provided with the holes for the passage of the gas, is surrounded by, and embedded in, a nozzle of material which is a bad conductor of heat—such as soap-stone, porcelain, or the like.

According to fig. 1, the bottom plate of the nozzle B is provided with holes F for the passage of the gas into the mixing-tube E, which has air holes D—the air for combustion supplied through these holes being previously heated in any suitable manner. This burner is said to offer the advantage that no deposit will be formed at the nozzle. A further advantage is that the end of the nozzle in which the gas holes are provided, "will not be deformed when the burner is put in place or cleaned, so that the gas-jets remain of constant direction with regard to the mixing-tube, which circumstance is very important for obtaining a uniform and steady light."



Mannesmann's Inverted Gas-Burners.

In fig. 2, the bottom of the nozzle B can be made of metal; but this construction does not possess the second of the advantages of the burner shown in fig. 1.

According to fig. 3, the nozzle B is made with a flat and horizontal bottom part, whereby "it is avoided that the air for combustion comes into contact with the side of the nozzle, but flows along the surface of the bottom plate—thus greatly facilitating the keeping cool of the nozzle."

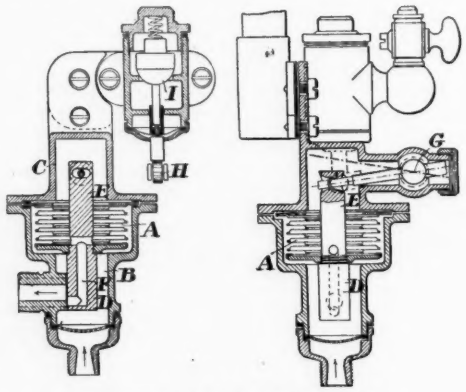
According to fig. 4, the nozzle B is furnished with an inner nozzle C, which eventually may be made from metal and the bottom plate of which has holes which are much smaller than the holes of the bottom plate of the outer nozzle, but coincide with them in such a manner that the gas flowing out through the small holes can freely pass through the other holes, even when they should be clogged. With back-lighting, this construction offers the advantage that the flame will never reach the inner gas holes but only burn at the outer bottom plate.

Automatic Gas-Valve Openers for Liquid Heaters.

DEUTSCHE CONTINENTAL GAS GESELLSCHAFT, and FRITZ MUCKE, of Dessau, Germany.

No. 28,495; Dec. 13, 1906. Date claimed under International Convention, Dec. 15, 1905.

This invention has reference to heaters in which the water flowing through is heated by a gas burner of the kind which effect the automatic opening of the gas-valve when the flow of water to the heating body is opened, and particularly to such devices when used with high-pressure heaters.



A German Water-Heater Regulator.

An elastic box A, acting as a membrane, is arranged in the casing of the gas-valve opener, and divides the casing into two chambers B C. On a plate on the lower part of the box A, and correspondingly displaced when the latter is compressed or extended, a piston or circular slide-valve D is mounted. The piston enters the chamber B, and presents at its upper part a bolt-like extension E, which projects into the chamber C. The water admission socket connected with the main service-pipe opens into the chamber B, as does also the water-discharge socket connected with the liquid heater. The latter socket is normally closed by the piston slide-valve D, and is only opened when the piston moves upwards. The valve is provided with an inner passage F, by means of which the water-discharge socket is constantly in communication with the chamber C. The bolt E is formed with a slot at its upper part, in which an arm mounted on a rotatable shaft G engages. The shaft carries on its end projecting outside the casing a lever, which, by means of a roller, acts upon a stud connected with the gas-valve I. Thus when the piston slide-valve D moves upwards for the purpose of opening the water-discharge socket, the gas-valve I is also opened by the rotation of the levers.

If the cocks for drawing-off water from the heater are closed, the same pressure prevails in both chambers B C, and the piston slide-valve occupies the position shown, in which the water-discharge socket and the gas-valve I are closed. When water is withdrawn from the heater in the first place, the chamber C empties through the passage F. By this means a difference of pressure is produced on the two sides of the elastic box A; the pressure in the chamber B being higher

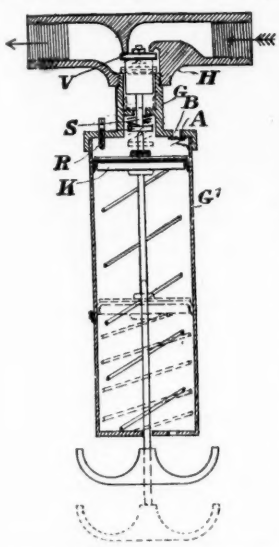
than that in the chamber C. Owing to this difference of pressure, the box A is compressed so that the valve B is raised. Owing to the upward movement of the valve, the mouth of the socket is freed to a greater or less extent, so that water is able to flow to the heater. At the same time, owing to the upward movement of the valve, the gas-valve I is opened, and the gas (kindled at an appropriate flame) heats the water flowing through the heater. When water is no longer being withdrawn from the heater, equilibrium of pressure is re-established in the two chambers B C, and the piston slide-valve D returns to the normal position shown.

Opening and Automatically Closing Gas-Pipes.

SPANGENBERG, F. A., Grosz-Salze, Germany.

No. 28,891 ; Dec. 18, 1906,

This is a device for opening and automatically closing the gas-pipes which lead to burners provided with pilot-lights, after a certain time of gas delivery—the closing of the pipes being retarded by a braking device which consists of an air cylinder and a spring-weighted piston.



Spangenberg's Automatic Gas-Pipe Opener and Closer.

The cock casing H is in (say) the gas-pipe near the street door, and in connection with a cylinder G, to which a cylinder G^1 is joined. The valve body V (preferably shaped as a circular plate, furnished with stuffing-discs at both surfaces) is connected to a piston which slides in the cylinder G. Extending from the bottom surface of the piston is a rod furnished with a disc. Between this disc and the bottom wall of the cylinder G is a spring S, which acts upon the disc so as to keep the valve permanently in an open position. G^1 represents the air-cylinder, in which is the piston K, the piston-rod of which projects with one end through the bottom wall of the cylinder, and is provided with a handle on its lower end. Between the piston K and the bottom wall of the cylinder a spring is inserted, which acts against the piston, to keep it in its highest position near the muzzle of the cylinder G.

The space above the piston K communicates with the atmosphere by the aperture B, which is covered by a flap A in the event of compressed air being contained in the air-cylinder above the piston. The compressed air can then only escape successively along the thread of a regulating screw R which fits in a female thread in the flange of the cylinder. The screw is made conical, so as to be able to adjust the space between the male and the female thread. In the bottom of the cylinder an aperture is provided, through which air freely enters and escapes.

The operation of the device is as follows: Upon entering a house, the piston K is to be pulled down by the handle, whereby the flap A opens, and air enters the space above the piston. When pulling the piston down, the spring S is released of any pressure, and exerts its power to open the muzzle of the delivery-pipe, and consequently gas flows to the burners, which (being furnished with pilot-lights) are ignited. The gas pressure acts against the piston V, and presses it with its disc tight against the edge of the cylinder G, so that no gas can penetrate the cylinder G^1. Through the piston K being drawn out, the spring around it becomes tensioned, and exerts a power to the piston upon the handle being released. Consequently, the piston is forced upwards again, and shuts at first the flap A so as to cover the entrance B. The continued action of the spring against the piston compresses the air contained in the cylinder G^1 more and more, whereby the air successively escapes through the space left between the screw R and the corresponding female thread. The piston is pushed upwards until the piston-rod projecting through the piston V reaches an abutment in the form of a disc; and upon the piston being pushed upwards again, so as to abut against the muzzle of the gas-delivery pipe, the supply of gas to the burners is cut off again.

APPLICATIONS FOR LETTERS PATENT.

8901A—2A—2B.—ALEXANDER, A. E., "Cleaning water-mains." A communication from the National Water-Main Cleaning Company. Aug. 21.

18,699.—RIGG, J., "Stoves and water-heaters." Aug. 19.

18,720.—SAMUEL CUTLER, jun., and HUSBAND, J., "Deep filled gas-purifiers." Aug. 19.

18,762.—MACKENZIE, J., "Recording apparatus for indicating water-levels or other movements." Aug. 20.

18,813.—SHAW, A., "Blowers and the like." Aug. 21.

18,815.—HOTTON, C. J., "Anti-vibrator." Aug. 21.

18,856.—PARKER, T., "Fuel." Aug. 21.

18,859.—PEAT, J. B., "Valves." Aug. 21.

18,882.—LAW, J., "Mantle-holder." Aug. 22.

18,990.—BAYES, R. J. H., and HILL, A. B. L., "Acetylene-generator." Aug. 23.

19,009.—BARDOT, E., "Gas-generators." Aug. 23.

19,036.—YARROW and CO. (BOLTON), LTD., and YARROW, M., "Joints in pipes or mains." Aug. 24.

19,082.—PARKER, T., "Apparatus for the destructive distillation of carbonaceous substances." Aug. 24.

19,100.—BERNHEIMER, J., and GUT, A., "Mantles." Aug. 24.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Socialism and Gas Companies.

SIR,—A few Sundays ago, the Socialists held a series of so-called "revival meetings" on Peckham Rye, to endeavour to drive home their specious doctrines. Among the speakers was a town councillor of Bradford and a Mr. C. W. Hartley, a borough councillor of Camberwell; also a Yorkshireman from Bradford who had been for ten years a member of the Corporation. The last-named is by all accounts a very easy and forcible speaker, who held an attentive audience for about an hour. He was interesting, because his topic was on "Coal and Gas Supply;" and, coming from the Bradford Corporation, he evidently knew the details of the gas-works there. I give some of his figures, culled from their own organ, the "Dulwich Post."

In 1871 the Municipality bought the gas-works at Bradford. They had to pay £95 for the £25 shares; but, even after that extortionate figure, the price of gas was soon after reduced from 3s. 1d. to 1s. 10d. per 1000 cubic feet. The Gas Company made the men work 82 hours for 19s. and £1 per week; but the Bradford Corporation gave 26s. for 47 hours' work. Coal has gone up in price. Some 252,000,000 tons are used in a year; and all the coal mines are worth £110,000,000. The increased price of coal brings into rich coalmen £42,000,000 a year. I would nationalize the coal mines, and pay them out in three years, and then have £16,000,000 for old-age pensions. Send 500 Socialists to Parliament and they will do that in six months. For 20 years coal at the pit's mouth cost only 7s. 3d. per ton. What do they pay for it in London? [A Voice: 27s. 3d.] Who gets all the difference? Who gets even the 7s. 3d. at the pit's mouth? Not the man who gets it out of the pit. The man who lounges in Park Lane gets 3s. 6d. of it; the collier who gets it out only earns 1s. 6d.

On being asked how he would buy the mines—where the money would come from, Mr. Hartley replied that he would do in the same way as with the Water Companies. He went on to say that Socialism was the simplest thing in the world—it would not upset anything. His advice was for them to get ready, and when they were ready it should be done. They did not want it yet; but it was waiting for them when they did.

"Lamplighter"—evidently the same orator—commenting on the subject in a leader in the above-named paper, headed "Gas Monopoly: Eternal Dividends *v.* Public Ownership," dilated on the "iniquity" of privately-owned gas-works, with an eye on the "Old Kent Road" business. Speaking of municipally-owned gas-works in the coal-bearing area and the southern gas companies' great distances from the pit's mouth, he said:

What difference does that make? The same rich men who draw eternal dividends from gas and coal are the very same people who draw them from railways. My point is that coal, gas, and railways should all belong to the people. Why should it cost more to bring 1000 tons of coal to London than to Manchester? It costs no more to deliver 1000 letters in the Old Kent Road than in Manchester. Why? Because there are no dividends to be grabbed in H.M. Post Office. You can deposit 1s. or £50 in the Post Office Savings Bank at Peckham, and take it out at Killarney or the Scilly Isles. That's State Socialism; and the same system will be used directly the people wake up to the question of coal, the supply of gas, and railway transit. As regards gas, it is the height of folly for gas workers to slave away from day to day, and then give their wages to the dividend grabbers who do nothing. There will be no trouble in buying them out. The rich men with money will only be glad to "invest" or lend it to the whole people. The other day a London County Council loan was subscribed for thirty times over.

In another part of the same paper, we are told that "the man who lights the street-lamps is of as good service to the community as the manager." Truly, this periodical is quite a "Gas issue." I note, however, that nothing was said about the contentment (not slavery) of the gas workers at the neighbouring Old Kent Road works, with their large sums invested in this co-operative Gas Company, with its bonuses and dividends to workmen, co-partnership, and workmen directors, and their share in the wealth they create—a Company who, though so far removed from the coal-bearing area, have been able to sell gas at only 2d. per 1000 cubic feet higher than the Bradford Corporation, with all their advantages of nearness to the pits' mouth. Compare this with the position of many trade unionist workmen, who for the weekly sums paid to their Union receive only "stones for bread," in lieu of a share in the industry they produce.

Aug. 27, 1907. LUX.

PARLIAMENTARY INTELLIGENCE.

CLOSE OF THE SESSION.

The remaining Bills in which our readers are interested—viz., the Colne Valley Water Bill, the Llandrindod Wells Gas Bill, the Metropolitan Water Board (Charges, &c.) Bill, the Metropolitan Water Board (Various Powers) Bill, and the Renfrewshire Upper District (Eastwood and Mearns) Water Bill—duly received the Royal Assent; and Parliament was prorogued last Wednesday.

The Export of Coal.

In the House of Commons on Monday last week, Mr. Fell returned to the subject of the export of coal by asking the President of the Board of Trade (Mr. Lloyd-George) whether the latest returns showed any slackening of the abnormal demand for coal from the Continent; and whether he could give the amount of the export from the United

Kingdom during the months of June and July of each of the years 1905, 1906, and 1907. In a printed reply, Mr. Lloyd-George said he was informed, on inquiry at the Customs, that there was at present no indication of a slackening in the demand for British coal on the Continent. He appended the following statement, giving the figures required by the honourable member:—

	Exports to European Countries.	Exports to Other Destinations.	Total.
1905—June.	3,153,421 tons	675,835 tons	3,829,256 tons
July.	3,423,086 ,,	708,987 ,,	4,132,073 ,,
1906—June.	3,571,938 ,,	693,879 ,,	4,265,817 ,,
July.	4,128,940 ,,	898,222 ,,	5,027,162 ,,
1907—June.	4,405,584 ,,	915,509 ,,	5,321,093 ,,
July.	5,259,453 ,,	839,210 ,,	6,098,663 ,,

In a letter to "The Times" on Thursday last, Mr. Fell reminded the readers of that paper that Sir George Livesey considers that the present excessive price of coal is largely due to its increased export from this country since the duty of 1s. a ton was taken off by Mr. Asquith; while that gentleman himself, in reply to questions put to him in the House of Commons, declared that he disagrees with Sir George Livesey, and holds that the increased export of coal is not in any way owing to the taking off of the duty. Mr. Fell then quoted some of the above figures, and said: "It is difficult, in face of these figures, to contend that the abolition of the duty in 1906 did not stimulate the foreign demand for our coal. The question, however, remains whether the advantages of the increased export are not hardly purchased at the expense of our manufactories, which in the case of our malthouses are now paying 7s. a ton more for coal than last year, of our railways, our steamship lines, our gas-works, and, above all, of our home consumers, who will have to pay this winter 3s. or 4s. a ton more for their coal than they paid last year. A long, hard winter and dear coal is not a pleasant prospect to look forward to."

MISCELLANEOUS NEWS.

PRESENTATION TO DR. JEFFERY, OF EASTBOURNE.

Fifty Years a Gas Director.

As briefly mentioned in another column, the proceedings at the last half-yearly meeting of the Eastbourne Gas Company were of an unusually interesting character from the fact that opportunity was taken on that occasion of testifying the shareholders' appreciation of the services rendered to the Company by the Chairman—Dr. G. A. Jeffery, J.P.—during his half-century's membership of the Board (to which he was re-elected at the meeting), by the presentation to him of a massive silver salver, accompanied by an album containing the names of the subscribers to the testimonial.

Dr. Bransby Roberts, in making the presentation, said he had been honoured, as the mouthpiece of the Committee and subscribers—and he must add, he thought, as an old friend—by being asked to perform the very pleasant duty of expressing on their behalf their most cordial congratulations to Dr. Jeffery on his being again elected a Director of the Company—an event, he supposed, if not absolutely unique, still very nearly approaching to it when they considered that he had now filled the important positions of Director and Chairman for half-a-century. There were few who had had the privilege of the friendship of the Chairman and of watching his career so long as he (the speaker) had; and when he mentioned that the period exceeded fifty years, he thought they would agree with him that it was a long one. His career was always a distinguished one. In the early period to which he had referred, when the population of Eastbourne numbered about 4000, the Gas Company were fortunate enough to enlist the energies of Dr. Jeffery; and, thanks to his wisdom and acumen, ably seconded by the co-operation of the Board of Directors and the staff, the Company from that date had really never looked back, but had progressed with the times. He might, perhaps, be allowed to interpolate a few figures which had been placed in his hands. There was a copy of the report of the Directors of Aug. 17, 1857; but he would pass over that, and merely give a comparison between that date and the present time. The consumers had grown from the 215 of which they were rather proud in those days to 8390. The total receipts for gas sold to private consumers for the year had risen from £787 to £53,808; and those for gas employed for public lighting from £235 to £5212. Lastly, the 5 per cent. dividend of the past was now 15 per cent. As he had said, the Company, progressing with the times, had become the valuable institution and financial success which they saw to-day—adding to the comfort and well-being of thousands of all classes of society, from the lowest to the highest. He need hardly remind those present that, though they had been thankful for, and applauded, this success, it had not been attained without the exercise of unceasing vigilance and business capacity. Periods of much anxiety must occur in any company both from without and within; and upon the Chairman and Directors especially fell the stress of meeting these difficulties as they arose; and without both tact and resourcefulness on the part of the Chairman these difficulties could never have been so readily surmounted. In fact, he might say that Dr. Jeffery had been a tower of strength to the Company ever since he took a prominent part in its affairs. To mark this, he (the speaker) had been deputed, on behalf of the subscribers whose names were inscribed in the album, to ask Dr. Jeffery's acceptance of the salver, as a slight memento of their gratitude for past services, and as a feeble expression of their good wishes for the future—hoping that he might be spared for many years of usefulness and happiness.

Alderman Miles (the Mayor of Lewes) also spoke, bearing testimony to the high esteem in which Dr. Jeffery was held not only in Eastbourne but beyond the limits of the borough.

Dr. Jeffery, who was evidently very deeply moved, briefly replied. He said he should value the gift as long as he lived, as an expression of kindness—not only to himself but to his family—for the little he had been able to do in connection with the Company. It was true that he became a Director fifty years ago, and was elected Chairman within three years. Therefore he had seen everything connected with the Company. He had sat with colleagues and friends—some living, some gone. He thanked the subscribers sincerely for their kindness in giving him this piece of plate, which he should prize all his life, and which would be treasured by those who came after him.

On behalf of the Directors and the principal officials of the Company, Alderman Towner presented to Mrs. Jeffery a handsome silver rose-bowl; and, at her request, the gift was acknowledged by Dr. Jeffery.

Mr. H. E. Jones, the Company's Consulting Engineer, as the senior officer, asked the acceptance by Dr. Jeffery's sons and daughters of a very striking likeness of their worthy father, handsomely framed.

Mr. F. A. Jeffery, who returned thanks, said they should always value the picture very highly.

Referring to the meeting and the presentation, the writer of "Local Notes" in the "Eastbourne Gazette" last Wednesday said: "Business and pleasure were happily blended at the half-yearly meeting of the shareholders of the Eastbourne Gas Company on Monday afternoon. Notwithstanding the increased cost of coal, the customary substantial dividends were declared; and the Directors will do their best to keep down the expenditure and maintain the profits at a satisfactory figure. After the customary resolutions had been submitted and adopted, a presentation was made to Dr. G. A. Jeffery, J.P. (the Chairman), in recognition of his services as Director during the past fifty years. The sum obtained represented the contributions of a large number of the shareholders, who found a spokesman in Dr. Bransby Roberts. It is well known that the position of a director of a prosperous gas company is coveted by many, and that it carries with it certain emoluments. Dr. Jeffery and his colleagues can fairly claim that they have pursued a progressive but prudent policy; and a fair share of credit must be accorded to the Resident Engineer and Manager and to the Secretary (Mr. J. S. Garrard). Mr. Hammond resides at the works; his attention to his duties is unremitting; and instead of advocating costly appliances, he is constantly endeavouring to secure what, from his point of view, is the one thing needful—economy of production."

THE EARLY DAYS OF GAS IN LONDON.

The "Globe" last Tuesday contained the following extract from the number published on the corresponding date one hundred years ago. It related, as will be seen, to the intended formation of a National Light and Heat Company.

1.—Fifteen thousand subscriptions filled early on Thursday, the 18th August, and the last five thousand are now selling at 50 per cent. advance.

2.—All reserves must be paid before the 1st September, or be relinquished in favour of the present subscribers.

3.—To obviate the immense pressure of my rooms on Wednesday evenings, no admissions can be under 5s., or three for 10s. 6d. The free and the 1s. admissions of subscribers must also be suspended, in order that the audience may not annoy themselves.

4.—The noblemen and gentlemen trustees wishing to give public proofs in lighting the fronts of both Houses of Parliament, Treasury, Somerset House, Mansion House, Bank, East India House, Pall Mall, Grosvenor, Portman, and Finsbury Squares, and Cheapside, for which I am to ask permission and prepare estimates, &c., my time will be fully employed, as to render it impossible to attend my office for explanations, which may be had by printed questions and answers, and other publications of mine.

J. Winsor,
Inventor and Patentee of the Gas Lights,
97, Pall Mall.

N.B.—The deed remains for signature at the office every day from ten till four o'clock; but several distant subscribers may join in the cost of one power of attorney, which may be had at the office, and sent round to them for any period, to sign in their name.

GAS LIGHTING AT FRANKFORT-ON-MAIN.

The report for 1906-7 of the Frankfort Gas Company, who have a working agreement with the Frankfort undertaking of the Imperial Continental Gas Association, states that the price paid for Australian shale, f.o.b. Sydney, was the same as in the preceding year, as the result of a contract extending over several years. In the case of the requirements for Scotch cannel coal, an exceptional opportuntity was afforded of obtaining a portion of the tonnage needed by taking over a part of the stock of a German gas-works; while the remainder was procured directly from Scotland. The price, including the export duty, was somewhat less for cannel sorts than in the preceding year. Difficulties arose in the delivery of native gas coal from the pits concerned; and the deficiency, which amounted to as much as 40 per cent. of the monthly quantities contracted for, compelled the Company (for the first time since 1890) to have recourse to English gas coal, the prices being materially higher than the native quotations. The expenditure on the raw materials used was 3¼ per cent. greater than in 1905 6. The total sales of gas increased by 2 per cent. The consumption for cooking, heating, and engine purposes again experienced a material augmentation, and the public lighting was proportionately higher; but the use of gas for private illumination at the full agreement price declined. Larger quantities of tar were sold, although at depressed prices; but a somewhat greater profit was realized from the increased production of sulphate of ammonia. Including the balance forward, the net surplus profits available for disposal amounted to £22,501, as compared with £23,856 in 1905-6; and a dividend of 10 per cent. has been declared, being at the same rate as in the preceding year.

THE GAS SUPPLY OF BRIGHTON.

Interesting Reminiscences.

The Brighton and Hove General Gas Company will hold their half-yearly meeting on the 13th inst., on which occasion the Directors will report that the sales of gas in the six months ending the 30th of June were greater to the extent of 1·56 per cent. than those in the corresponding period of last year; while the rental was £1743 higher, and the net revenue from residual products £2132 more. The accounts show that the receipts from the sale of 593,708,600 cubic feet of gas amounted to £84,874; the rental of meters, stoves, and fittings to £8286; residuals produced £18,221; and the total revenue was £111,682. The principal items of expenditure were: Manufacture of gas, £55,365 (coals, coke, and oil costing £39,163); distribution, £17,501; rents, rates, and taxes, £4483; and management, £4742. The total expenses were £83,287; leaving £28,395 to go to the profit and loss account. The balance available for distribution is £38,246; and the Directors will recommend the payment of dividends at the rates of 6 and 4 per cent. per annum on the "B" and "C" preference stocks, and of 11¼ and 8¼ per cent. per annum on the original and "A" ordinary stocks. The payment of these dividends will absorb a sum of £24,236, and leave £14,010 to be carried forward. The Company's authorized capital is £695,000, of which £595,517 (including premiums) has been paid up; and the loan capital is £112,920. The total capital received is therefore £708,437; but to this must be added a sum of £2317, premiums received on debenture stock—making £710,754. The net amount expended up to the 30th of June was £653,299; so that there is an unexpended balance of £57,455. The Company have a reserve fund of £55,534, an insurance fund of £8352, and a depreciation fund of £7601. This is the present position of the Company; and as the current year is the centenary of gas lighting, and reminiscences of the early days of gas undertakings are of more than usual interest, it may not be out of place to reproduce some particulars in regard to Brighton which appeared in the "Sussex Daily News" on Monday last week.

The first mention made of the subject in local records is the Act of Parliament, dated 1818, which incorporated the Brighton Gaslight and Coke Company. At that period Brighton was circumscribed within a comparatively small area; and, roughly speaking, there were about 24,000 inhabitants and 3947 houses. The original Company was consequently a small affair. For some reason not easy to understand, they selected the high ground at Black Rock for the site of their works. From an engineering point of view, there were two objections to the site. It was not orthodox practice to put gas-works on top of a hill, from which height the product had to be forced down to the lower level; and it was scarcely economy to select a pitch so far away from a coast harbour which might be used for supplies of coal. The pioneers of gas in Brighton, however, had an ingenious way of overcoming the latter point. They brought the coal round from the North in small coasting vessels, which managed to discharge the cargo on to the beach at Black Rock, whence the coal was hauled through a subway in the cliffs into the retort-houses beyond. The passage is still in existence, though closed up; and there are also to be seen the remains of the machinery used in the process of transferring the coal from the beach. It is possible that this arrangement was carried out in order to avoid the coal dues which had been enforced for some years to defray the expenses of sea defences. If the coal had been unshipped at Shoreham, it would have been brought into the borough *en route* to the gas-works at Kemp Town, and the levy would have been imposed upon each ton. By landing the coal just outside the jurisdiction of the Town Commissioners, the Company saved the dues, which may have compensated for the labour of hauling it up the cliffs.

What price was charged for gas in 1820 or what the Company had to pay for their coal, it has not been possible to trace. Whether the cost was prohibitive to the manufacturer or the consumer cannot be established; but it is certain the Company did not make much headway until 1824, when, according to a reference book, the Old Steine was first illuminated with gas. The circumstance is mentioned so specifically that one infers that this was the initial experiment in public lighting in Brighton by means of gas. The Steine was at that period the fashionable rendezvous; and presumably this would be the first district in which the authorities would introduce a public improvement. The fact indicates that the Gas Company were pushing mains well into the centre of the town. Gas lighting gave increased zest to the gaieties of the Steine. The sickly flame of the oil-lamp was banished; and the new illuminant was freely used to give brilliance and *éclat* to the nocturnal revelries of fashionable celebrities.

Brighton developed marvellously between 1820 and 1825; and the Company found their monopoly challenged by the promotion of the Brighton and Hove General Gas Company in 1824. This Company was established in 1825 and incorporated in 1839. At that time the works were in the midst of fields remote from any buildings. For a number of years the two Companies were in active opposition—both supplying gas in the same streets. There was fierce fighting for customers; and it was quite common for consumers to change from one service to the other. The new Company in this respect always had the advantage over the original concern. The gas was undoubtedly of greater illuminating power, and their methods were recognized as more up-to-date. On the other hand, the pioneers held their ground stubbornly under the generalship of Mr. J. O. N. Rutter, who made a name in the gas world as Superintendent of the Black Rock works.

However much the two concerns fought for trade, they were remarkably united in the price they charged for gas. When gas-meters were introduced, the price was as high as 10s. per 1000 cubic feet. Both Companies charged the same. When the price was reduced, it was by common consent; when it advanced, the same policy was pursued. Notifications of an increase in price in 1854, owing to the advance in the cost of coal, freight, iron, and other materials, evoked considerable indignation in the town, and a number of consumers wrote to the newspapers asking what the cost of iron had to do with the manufacture of gas. It seems that in the previous year the price of house coal had been at what was called "an unheard-of figure;" and consumers admitted that if the Gas Companies had raised their scale at that period there might have been justification for the policy. But as coal had dropped to normal quotations, and iron only affected their mains and pipes, the inhabitants regarded the demand as unwarranted. During this year, the "new" Company had a Bill in Parliament, and the authorities were urged to bring pressure to bear upon both concerns to lower their prices. Iron was admittedly dear at that period; the "boom" in railways having produced an enormous demand for the commodity. The 6s. scale did not last long. Brighton was going ahead rapidly; and the consumption of the gas expanding, the Companies soon found it desirable to lower their charges. The normal price soon became about 3s. 6d. per 1000 cubic feet, and the illuminating power improved.

It will have been gathered that up to this period the works of the two Companies were comparatively isolated at opposite extremities of the town. There is a tradition that the development of Kemp Town was checked by the existence of the Black Rock works; but an examination of old records has revealed that the interruption in the building at Kemp Town was attributed at the time far more to the proposal to establish a huge parochial cemetery in the neighbourhood than to the manufacture of gas. Much to the relief of the inhabitants, the burial-ground scheme fell through; and in another quarter-of-a century the district was relieved of the manufacture of gas. Mr. John Birch Paddon, who had come to be the Engineer and Manager of the Brighton and Hove Gas Company, carried out a bold stroke. Appreciating the desirability of getting away from the building operations in Hove fields, he decided upon removing the retort-houses to the banks of the Aldrington Canal—keeping only the gasholders in Hove. He planned the most up-to-date works at Portslade; and thus at one stroke freed Hove from the manufacture of gas and the eyesore of coal cartage. The Portslade works came into operation in 1872; and the next move in a progressive policy was the amalgamation of the two Companies, which was mutually agreed upon, and carried out by an Act of Parliament passed in 1881. This concentration enabled Mr. Paddon to stop the manufacture of gas at Black Rock, which was, of course, another immense advantage to the neighbourhood; while a substantial reduction of 3d. per 1000 cubic feet in the price intensified public satisfaction at the reorganization of the entire service. Mr. Paddon introduced many valuable improvements into the gas supply of the district. He did everything possible to encourage the authorities to improve street lighting; and in 1882 he made an arrangement with the Brighton Town Council by which the Company supplied and fitted the large octagonal Sugg's lanterns, with triple burners, along the whole of the sea-front. The entire cost of public lighting in Brighton at that period was between £8000 and £10,000 per annum. At present the Corporation are spending about £12,000 a year on electric lighting, and only about £4000 on gas. The popularity of gas in Brighton, in spite of competition, has never had a set-back. At the time of the amalgamation of the two Companies in 1882, the annual output was 639 million cubic feet; whereas last year it had reached 1169 million cubic feet.

Two years after the amalgamation of the Companies, the late Alderman Lamb boldly told his colleagues in the Town Council that it would be a good stroke of business on their part to acquire the gas supply of the district, and put into the Borough Treasury the revenue which went into the pockets of the shareholders of the Gas Company. Municipal trading had not developed into a policy in those days; and though there were many ready to accept the worthy Alderman's idea, no one ventured to put it into operation. Consequently nothing more was heard of the proposal until the year 1890, when, after a series of desultory experiments, the Corporation resolved to buy out the original Hammond Electric Lighting Company, and obtain a Provisional Order for the installation of a municipal system. Then the *quidnuncs* lifted their eyebrows, and fervently congratulated themselves that they had "not touched gas," inasmuch as they had now embarked in an illuminant which was destined to "extinguish" its predecessor in more senses than one. Much water has flown down channel since that pious aspiration. To transpose a well-known metaphor, it may be said that while electricity proposes, gas disposes. The irony of fate has never been more completely vindicated than in the relative positions of gas and electricity—perhaps one should say municipal electricity—at the present moment, after seventeen years of strenuous competition in Brighton. At a recent meeting of the Town Council, there was a discussion which suggests that members would hail with delight an exchange of their pet electricity undertaking for the prosperous gas supply. Ominous whispers of a deficit of thousands of pounds on last year's trading were in strange contrast with a report from the Borough Accountant, printed on the minutes of the Electricity Committee, which stated that the balance-sheet of the Brighton and Hove Gas Company showed a trading profit of £53,879 17s. 6d.; being equivalent to 7 5 per cent. on the paid-up capital. The Company's income for the year was £215,480, compared with £209,582 12s. 11d. for the preceding twelve months.

This contrast is striking enough in its way; but it is not more remarkable than another comparison. The gas undertaking has been in existence for upwards of seventy years, plodding on its own way with a well-ordered progress; and its development has entailed a total capital expenditure of £710,753. The electricity works of the Corporation have had an existence of seventeen years only. The total annual revenue amounts to £85,684, and the capital expenditure stands at £758,279. A Gas Company which has been able to withstand the vicissitudes of the municipal competition for seventeen years, and at the end of that period comes out with a better trading result than its rival, is an interesting local institution. The circumstance supplies another illustration of the survival of the fittest, in the sense that the result is largely due to all-round good management. For many years the Company have pursued a sound policy. There has been no garish display or loud trumpetings, but steady solid building up of a far-reaching public service, which has gained popularity on its merits. A year ago, in an important report on his annual audit of the Gas Company's accounts, the Borough Accountant drew certain examples from the item of depreciation; and he justified his own allocations under this heading in respect of municipal trading concerns by the method adopted by the Gas Company, which he characterized as "an admittedly well-managed business." The compliment was well deserved.

PROVINCIAL GAS AND WATER COMPANIES.

Gas.

Three Years' Progress at Bridport.

The revenue of the Bridport Gas Company for the year ending the 30th of June last, as shown by the accounts presented at the recent meeting, was £5633, and the expenditure £4565; leaving £1068 to go to the profit and loss account. The balance available for distribution was £1414; and the Directors recommended the payment of a dividend of 7 per cent. on the ordinary shares, less income-tax, which would absorb £983. It may be mentioned that the results of the Company's working have considerably improved since the appointment of the present Engineer and Manager (Mr. W. H. Reed) in June, 1904. The average cost of coal in the three years 1902-4 was 19s. 7d. per ton, and the value of the residuals was £978. In the three succeeding years, the figures were 18s. 1½d. and £1128. The average make of gas per ton in the former period was 9914 cubic feet, of which 8565 cubic feet were sold at a price of 4s. per 1000; in the latter, the figures were 10,445 and 9074 cubic feet, at prices of 3s. 9d. and 3s. 3d., the lower figure being for gas used for power. A marked improvement is shown in respect of the residuals. The average yields per ton of coal in the three years 1902-4 were: Coke, 9·2 cwt.; tar, 8·1 gallons; sulphate of ammonia, 10·2 lbs. In the succeeding three years they were: Coke, 10 4 cwt.; tar, 9·5 gallons; sulphate of ammonia, 16·3 lbs.

Extended Works and Increased Business at Chichester.

At the half-yearly meeting of the Chichester Gas Company on Monday last week, the Directors expressed their pleasure at reporting that the extensive alterations and improvements at the works, which have already been noticed in the "JOURNAL," have been completed, and that the business of the Company continued to increase. An exhibition of gas appliances held in February last, and the experimental lectures on cooking by gas delivered in connection with it, were very successful. The revenue for the six months ending June 30 amounted to £6452, and the expenditure to £4926; leaving £1526 to go to the profit and loss account. The balance available for distribution was £2128; and out of it the Directors recommended the declaration of a dividend at the rate of 10 per cent. per annum upon the "A" stock, and of 7 per cent. per annum upon the "B" and "C" stocks, both less income-tax. The Chairman (Mr. Alfred Lass), in moving the adoption of the report, congratulated the shareholders on the completion of the extensions of the works and plant, and mentioned that all the public lamps had been converted from the flat-flame to the incandescent system. Dealing with the revenue account, he said the income from the sale of gas for the half year amounted to £4696; while for the corresponding period of 1906 it was £4564, or an increase of £132. This was highly satisfactory, when taking into consideration the reduction of 1d. per 1000 cubic feet; the price now being 3s. 3d. against 3s. 4d. this time last year. The gas made in the six months was 31,174,000 cubic feet, compared with 29,954,000 cubic feet before, or an increase of 1,220,000 cubic feet. When he mentioned that this had been obtained by the carbonization of 259 tons less coal, he thought the proprietors would agree with him that the result was satisfactory. The gas made per ton of coal carbonized was 11,019 cubic feet, against 9700 cubic feet for the corresponding period of 1906; being an increase of 1319 cubic feet. There had been 654,800 cubic feet more gas sold; being at the rate of 9886 cubic feet per ton compared with 8844 cubic feet before. Having dealt in detail with the various items in the accounts, the Chairman said the business of the Company had considerably increased during the past ten years. The quantity of gas sold in the six months ended June 30, 1897, was 17,709,500 cubic feet; whereas the quantity of gas sold during the half year ended June 30, 1907, was 27,709,500 cubic feet—an increase of 10,258,100 cubic feet, or at the rate of about 5 per cent. per annum compound. This meant that the sale of gas would double itself in about fourteen years. The price had also been reduced during the last seven years from 4s. to 3s. 3d. per 1000 cubic feet. In the past half year there had been an increase of 244 stoves and 82 prepayment meters. Referring to the rise in the price of coal, the Chairman said that, though other companies had given notice of advances in price ranging from 2d. to 5d. per 1000 cubic feet, the Directors hoped that the enhanced price of coke, the economies which the new works were designed to effect, and the expected augmentation in business, would to some extent meet the additional cost of coal. In these circumstances, they thought it desirable to await the future development of events before deciding upon either an increase in the price of gas or a decrease in the rate of dividend. In conclusion, he expressed his pleasure in stating that the Company's relationship with the city authorities was exceedingly amicable, and they desired it to be continued. Mr. W. A. Walker, the Manager of the Worthing Gas Company (who is a Director), having seconded the motion, Mr. Joseph Cash, the Engineer of the Brighton and Hove Gas Company, congratulated the Directors upon the completion of the important extensions of the works which had been in progress during the past two years, the wisdom of which was fully justified by the results now published in comparison with those of previous years. He paid a high compliment to the Manager (Mr. T. E. Pye) for the work done during the half year, the returns of which, he said, compared very favourably with those of much larger works. The motion was carried, and the usual dividends were declared.

A Judicious Purchase of Coal at Eastbourne.

At the half-yearly general meeting of the Eastbourne Gas Company on Monday last week, the Directors submitted accounts which showed a profit of £8475 on the working in the six months ending the 30th of June last; the revenue having amounted to £35,909, and the expenditure to £27,434. The amount available for distribution was £25,173; and the Directors recommended that a dividend should be declared for the half year at the rate of 15 per cent. per annum on the original capital, and also on that raised on "C" shares, and at the rate of 12 per cent. per annum on the capital raised on "B" shares. This would absorb £7837, and leave a balance of £17,336 to be carried forward. In moving the adoption of the report, the Chairman (Dr. G. A. Jeffery) remarked that during the half year to which it referred the profits had been sufficient to enable the Company to pay the usual dividends, after making due allowance for wear and tear and depreciation. This, at a time when other gas companies were trenching on their reserves or raising the selling price of gas, was a boon. They had hoped on this occasion to lower their charge from 2s. 8d. to 2s. 6d. per 1000 cubic feet; but, considering the high price of coals, they thought they were wise in holding their hands for the present. The shareholders must allow the Directors to take credit for their forethought in purchasing at a cheap rate a two years' instead of a year's supply of coal; and now, by the purchase of 10,000 tons only, they had sufficient to carry them on to next September twelvemonths. Until recently there was an export duty of 1s. per ton on coals. In a silly moment, he thought, the Government repealed this, cut off revenue from an outside source, and therefore made the foreigner the recipient of what the British taxpayer had to pay. This was hardly fair, because the great industries of the country were now burdened by this severe rise in the price of coal. There had been a satisfactory increase of 5½ per cent. in the sale of gas, and coke had sold very well; but tar had not been quite so valuable. When he looked at the excellent roads made by the Corporation of Eastbourne, he thought there might be a future for tar. Mr. A. W. Oke seconded the motion, and it was carried. The dividends recommended were then declared; and thanks were accorded to the Directors, officers, and staff. Subsequently a presentation was made to the Chairman, an account of which appears elsewhere.

Popularity of Slot Meters at Farnworth.

The half-yearly general meeting of the Farnworth and Kearsley Gas Company was held last Thursday, under the presidency of Alderman James Fletcher, J.P. The Directors reported that the balance of net profit was £2453, which with £308 received for interest on the reserve fund made a total balance of £2761. During the half year the expenditure for coal, repairs, &c., amounted to £1213 more than in the corresponding period of the previous year. The sale of gas had increased by 4¼ per cent, and during the six months 212 new consumers and 124 cookers and grillers had been added. The Chairman, in moving the adoption of the report, said the recent reduction in the price of gas had benefited the consumers to the extent of £583; and though there was a satisfactory increase in the sale of gas, the revenue from this source showed a falling off to the extent of £270 compared with the first half of the past year. He reminded the shareholders that the recent advance in the price of coal would have a serious effect in diminishing the Company's profits. The present contracts had been arranged at an advance of 2s. 6½d. per ton, which was equivalent to an increase of 3d. per 1000 cubic feet upon the previous rate. But the Directors hoped that, owing to the accumulated reserve fund, they would be able to meet the crisis without having to alter the price of gas. He concluded by referring to the popularity of the slot meters, of which, he said, 2785 were now in use—being a large increase. Dividends at the rates of 10 and 7 per cent. per annum were declared.

Increasing Popularity of Gas at Harrogate.

At the half-yearly meeting of the Harrogate Gas Company last Thursday, the Chairman (Mr. F. Barber), in moving the same interim dividend as before, reported satisfactory working in the six months ending the 30th of June, due to an increased consumption, which compared well with the corresponding period of the previous year. He attributed the favourable position of the Company entirely to the increasing popularity of gas, and to the realization of its commercial advantages over all competitors; and he looked forward, on the return of more normal conditions, to a further boom in the Company's prosperity. In view of the continued heavy demand for export coal, he considered it wiser to respect the present firmness of the market, and not be unmindful that prices might go even higher. The past half year had not been affected by the increased price; but the Company had to face in their present coal contracts an increase of 2s. 8d. per ton. He was, however, glad to be able to report that, after careful tests under working conditions, a combination of coal had been found to produce such commercial results as would largely minimize, if not entirely meet, the advance in price. Though it was unwise to prophesy, they had very good hope of maintaining their present position with the consumers without any reduced profit to themselves. They did not mean to depopularize gas by raising its price on account of the increase in the cost of coal, so long as their management, by the exercise of superior skill, were able to meet the contingency by greater efficiency in working. He congratulated the proprietors upon the high position which their stocks maintained in the market, notwithstanding the enormous depreciation which had taken place in all gilt-edged securities. In conclusion, he congratulated their General Manager (Mr. H. Wilkinson) upon his appointment to the presidency of the North of England Gas Managers' Association. This was regarded as a position of great distinction among gas managers in the North; and he knew no gentleman more deserving of the honour.

Coal Advances Fifty Per Cent. in Two Years at Hartlepool.

The Directors of the Hartlepool Gas and Water Company, in the report which they submitted to the recent annual meeting, stated that the total revenue for the year to June 30 amounted to £89,539, against an expenditure, including interest on loans, of £57,461; leaving a balance of £32,078. An interim dividend was paid in March last, and the Board recommended the declaration of a like dividend for the past half year—namely, at the rate of 5 per cent. per annum on the whole of the paid-up consolidated capital of the Company, less income-tax. The quantity of gas sold during the year was 396,951,640 cubic feet, an increase of 1,295,431 feet upon the previous year. The sale of water had also been satisfactory; and there had been a constant and ample supply available throughout the year for both domestic and trade purposes. The large quantity of soft water in store in the Company's reservoirs at present constituted a record for this season of the year. A telescopic gasholder erected at No. 1 gas-works in 1864 had for some years back shown signs of rapid deterioration; and at the present time it was being replaced by a three-lift columnless holder of the most modern construction, having an increased capacity of 50 per cent. The Chairman (Mr. Thomas Appleby, J.P.), in moving the adoption of the report and balance-sheet, referred to the great increase in the cost

of coal. By strict economy, he said, the Directors had during the past year been able to avoid raising the price of gas, and to recommend the payment of the maximum dividend and carry forward a balance of £155. He wished he could speak hopefully for the current year. The price of coal had risen to such an extent as to represent on this year's contracts an increase of £7500 above last year. On the two years, the price of coal had advanced about 50 per cent. The Directors fully realized that the shareholders were entitled to a maximum dividend of 5 per cent. (which only represented about 4 per cent. upon the market value of the stock, and was certainly not too much). They hoped to accomplish this without having recourse to raising the price of gas; but should it be necessary, they would not hesitate to do so—believing that the consumers would recognize the reasonableness of such action under the exceptional circumstances. To meet the extra cost of coal, they looked for increased revenue from the sale of residuals, especially coke, and also from the sale of water; while it was also hoped to effect a further reduction of expenditure. But should these hopes not be realized, they would be compelled to raise the price of gas. The sales of both gas and water had been satisfactory; and the Directors had for some time past been overhauling and renewing the plant, with a view to being ready to meet further requirements. It was expected that the new gasholder referred to in the report would be ready for work on Oct. 1. The consumption of gas through slot-meters continued to increase steadily, no fewer than 425 additional consumers having been added during the year; making a total of 7033 of these meters in use, which contributed nearly £8000 to last year's revenue. Sulphate of ammonia had maintained a steady attitude during the year, the variations in price having been less than usual—due, no doubt, to the continued increased export of the material to Japan and Spain. This was still one of the best and cheapest artificial manures; and those farmers who during the late wet season had used it in preference to nitrate of soda, would have fully realized its advantages. The tar market had been very flat most of the year—receipts from this source being nearly £250 less; and so long as the large quantities of tar now produced by colliery owners and others at coke ovens continued to be put on the market, there was little prospect of the product improving in price, unless new markets could be found for its use. Local authorities having charge of highways would find it serviceable and economical for their roads and footpaths both in construction and durability, and also as a means of diminishing dust. Of Coalite much had been said, and great hope was entertained that by its use the smoke nuisance in large cities and towns was doomed. All must welcome any innovation tending to clear the atmosphere of the great amount of impurities it now contained, and much of which was quite avoidable. The report was adopted.

Steady Progress at Salisbury.

Presiding at the annual meeting of the Salisbury Gas Company, Mr. George Fullford, J.P., was happily able once more to congratulate the shareholders on the satisfactory position of the undertaking. Referring to the accounts, he said it would be seen that there had been a reduction on the cost of coal as compared with the previous year; while wages and repairs showed a slight increase, and distribution charges were somewhat higher. In regard to income, there was an increase all along the line—in sales of gas, of residuals, and rents of meters and appliances. On the whole, the accounts were very satisfactory, and showed sound and steady progress. The balance on the right side would enable the Company to tide over the large advance in the price of coal, which, on the current year's contracts, amounted to about £850, and avoid raising the price of gas to the consumers. They had always been willing to adopt improvements of proved utility; and the new regenerator furnaces in the retort-houses, and the enlarged purifying apparatus lately erected to the design and under the control of their Engineer and Manager (Mr. Norton H. Humphrys) were doing good work—making better gas at a lower cost. The slot-meter was a growing department of the business; and the maintenance in good order of incandescent burners by their staff of skilled workmen, for both inside and outside lighting, continued to give great satisfaction. The stock of stoves and cookers on hire had been added to during the year; and the Directors were thoroughly satisfied with the loyal support they had received from the officers and staff, and the large number of men engaged in the numerous departments covered by their operations. The report and accounts were adopted. At a subsequent extraordinary meeting, the Directors were authorized to raise £2500 of 4 per cent. debenture stock.

A Record Report at Tonbridge.

The half-yearly meeting of the Tonbridge Gas Company was held on Monday last week. In moving the adoption of the report, the Chairman (Mr. John Fagg) said it was the best and most satisfactory one he had had the pleasure of submitting to the shareholders. The Directors had reduced the price of gas from 2s. 10d. to 2s. 8d. per 1000 cubic feet from the 1st of January last—a price which compared favourably with that charged in any other town similarly situated in the South of England. Under the sliding-scale clauses of the Company's Provisional Orders, this reduction entitled the shareholders to an extra ½ per cent. in the rate of dividend on the "A," "B," "D," and "E," stocks; and this statutory increase the Directors recommended. Though the price of gas had been reduced by 2d. per 1000 cubic feet, the amount received from its sale and from meter and stove rental for the six months ending the 30th of June was £283 more than for the corresponding period of last year. The reduction accounted for £350; but this amount had been made up and the revenue improved by £283 by the extra quantity of gas sold. The increase in consumption for the half year was 3¾ million cubic feet, or 9 per cent, and was three times the increase for the whole of last year. Residuals also showed a very satisfactory improvement. A considerable quantity of tar had been sold for spraying roads; and it had been sent to different parts of the county for the purpose. The Directors regretted that this year's coal contract showed a very substantial rise in the price they had to pay; but they hoped that, by studying every economy, gas might still be supplied to consumers at the present exceptionally low figure. The Directors had decided to lay a high-pressure main in the High Street, for the purpose of supplying high-power lamps to consumers. The balance on revenue account was £2518, and added to the amount brought forward, made a total of £6770 available for distribution. The Directors recommended that dividends be declared at the rates of 12½ per cent. per annum on the "A" stock and 9½ per cent. per annum on the "B," "D," and "E" stocks. This was agreed to. A hearty vote of thanks was accorded to the Chairman and Directors, as well as to the Engineer and Secretary (Mr. James Donaldson).

A Rise in Price at Truro.

The report which was adopted at the annual meeting of the Truro Gas Company stated that there had been a steady increase in the business, notwithstanding the growing competition of other forms of light and power. The continued rise in the cost of coal and freights had given the Directors much anxiety; and as they were unable to renew contracts at prices anything approaching those ruling last year, they were most reluctantly compelled to announce an increase in the price of gas of 2d. per 1000 cubic feet, to take effect from the 1st of July last. Owing to the reduction in the price of gas supplied to large power users, the net revenue from gas sold showed a decrease, though the total quantity sent out had slightly increased. This, together with the greater cost of coal, accounted for a slight reduction in the profit earned. Out of the balance standing to the credit of profit and loss account—£1822—the Directors recommended the payment of a dividend at the rate of 5 per cent. per annum, less income-tax, which would leave £41 to be carried forward to the next account. In order to clear off the temporary loan of £1500 from their bankers, rendered necessary by the purchase of the freehold of the gas-works and the extension of the works, and to provide additional working capital, the Directors recommended that they be authorized to issue additional 4 per cent. debenture stock to the extent of £2000.

A Cheerful Message to Consumers at Weymouth.

The report presented at the recent half-yearly general meeting of the Weymouth Consumers' Gas Company opened with the satisfactory statement that the quantity of gas sold in the six months ending the 30th of June was, in round numbers, 50 million cubic feet—being an increase at the rate of 4·9 per cent. on the sale in the corresponding half of last year. The Directors were able, on the 1st of April, to make a further reduction of 2d. per 1000 cubic feet (from 3s. 2d. to 3s.) in the price of gas, notwithstanding that the outlook in the coal market was not satisfactory. The prominent factors in the accounts accompanying the report were the reduction in price, a diminished yield from residual products, the increased cost of coal, and an advance in rates. This combination of circumstances naturally caused the profit to be somewhat less than usual. The amount available for distribution, however, (£4908) justified the Directors in recommending the declaration of a dividend for the half year on the ordinary stock at the maximum rate of 5 per cent. per annum, less income-tax. The number of consumers continues to show a steady increase, and the output of gas has reached a point at which it is necessary to provide further storage accommodation. The Directors have therefore entered into contracts for the erection of an additional two-lift gasholder, with steel tank, which it is hoped will be in use early next year. In moving the adoption of the report, the Chairman (Mr. J. E. Robens) prefaced his observations on the work of the half year by an interesting account of the early days of gas lighting at Weymouth. He remarked that though illumination by coal gas was started in London in 1807, it was not until 1832 that it was adopted at Weymouth. When it was introduced by Mr. Burdon (one of their representatives), who built the works and established the first Gas Company, the illuminating power was 10 candles, and the price 12s. per 1000 cubic feet. In 1835, when he (the speaker) began business, it had been reduced to 10s.; and then, as they all knew, it went on falling until it came to 5s. 6d., which was the price when the Company was formed. They purchased the old concern and had carried it on ever since. The price of gas was reduced at once to 4s. 6d., and the illuminating power rose from 10 to 14 candles. They considered they had carried on the business to the general satisfaction of the public. From 5s. 6d., which was the charge when they purchased the undertaking, they had reduced the price to 3s. Looking back through the century, what changes had taken place and what improvements had been made in gas! If it were removed now, it would not only mean that lighting power would be taken from the streets, but their domestic affairs would be affected; for gas had now entered into almost every house in some way or another for the benefit of the householder. Passing on to deal in detail with the items in the accounts, the Chairman mentioned that the rates were £160 more than they were in the previous half year. This was a matter to which they did not intend to submit quietly; for they had entrusted it to Mr. Valon, who was well known to the Board, and nobody was better acquainted with matters appertaining to gas-works than he. Referring to the reduction made in the price of gas, the Chairman combated a statement made by the Chairman of the Electric Lighting Committee of the Corporation to the effect that this concession to the consumers was due to the influence of the Committee. He said nothing could be more untrue. They had reduced the price because they had a surplus which they felt belonged to the consumers. In five years they had lowered the price of gas to what it was at the present time, and they had given to the consumers £3500 by these acts because they had had cheap coals, and also by the large additions made to the number of consumers, which naturally had enhanced the profits. With regard to the present price of coal, they were not afraid of the future. They had a good reserve, and if the high price lasted a year or two, and they had the same income as at present, they would be prepared for it. They intended to keep the price of gas at 3s., and give the consumers the benefit of it. Mr. S. J. Fowler seconded the motion, and it was carried unanimously. A vote of thanks having been accorded to the Chairman and Directors, the services of the Engineer and Manager (Mr. D. F. Colson), the Secretary and Accountant (Mr. E. Y. Wood), and the employees were duly acknowledged, and the proceedings closed.

Coal, Coke, and Gas Prices at Wolverhampton.

At the meeting of the Wolverhampton Gas Company last Tuesday, the Directors, in their accounts and general balance-sheet for the six months ending June 30 last, stated that the net profit amounted to £9791. This, added to the balance brought forward, enabled them to

recommend the payment of dividends at the same rates as last half year—viz., 3 per cent. upon the preference stock, £5 2s. 6d. per cent. upon the consolidated stock, and £3 2s. 6d. per cent. upon the new ordinary stock, all less income-tax—and to carry the balance of the dividend undivided (£459) to the reserve fund. They further recommended that £228, interest for the half year, be placed to the credit of the reserve fund, and likewise £44, also interest, to the credit of the insurance fund; and that the balance of £7292 should be carried forward. The Chairman (Mr. B. O. Clark), in moving the adoption of the report, said every year showed improvement in the position of the Company. More gas was being made; and he had no doubt the higher quality of the coal employed was the reason for it. The question of the price gas coke would fetch next winter would have to be considered, and if it did not realize more, the charge for gas might have to be increased. The Directors would be sorry to do this; but though they had made their coal contracts in advance, their outlay for coal was much greater, and this would have to be recouped from somewhere. The number of prepayment meters in use had been increased by about 1000 during the past six months. The report was adopted, and the dividends recommended were declared.

Water.

Excessive Consumption of Water at Barnstaple.

Presiding at the recent meeting of the Barnstaple Water Company, Mr. C. E. R. Chanter referred to the satisfactory position of the undertaking both as regards the condition of the works and finances. The revenue, which amounted to £1776 for the half year, was £60 more than in the corresponding period of last year; while the expenses had amounted to only £705, as against £872. The construction of the new filter-bed had been completed; and the Company now had four filter-beds, three of which had been added since 1888. The Company were now sending into the town 880,000 gallons of filtered water per day, which was equal to 63 gallons per head of the population. Though their resources would amply meet a far larger demand, it was an extraordinary consumption; and he hoped the inhabitants of the town would be more careful. It was decided to pay dividends of 10s. and 7s. per share on the two classes of shares, with an addition of 1s. on account of back-dividends in the case of the older shares.

Drought Affects Revenue at Brymbo.

At the recent meeting of shareholders in the Brymbo Water Company, under the presidency of Sir Theodore Martin, the report and accounts presented showed that 4443 houses, &c., were now supplied with water—an increase of 110; but that the revenue was less than in the previous year by £133. Including a balance of £386 carried forward, the net revenue amounted to £3109. After deducting the interim dividend of 4 per cent. per annum paid in March, besides the interest on debentures, there remained a net balance of £1411 available for distribution. The Directors recommended that a dividend sufficient to make 4½ per cent. for the year be declared, free of income-tax, and that the sum of £136 be carried forward. Sir Theodore Martin, in moving the adoption of the report, remarked that the decreased revenue was due to the lamentable drought last year, which necessitated the curtailment of the trade supply. There was just as great an excess of rainfall this year as there was a scarcity last year. The Llyncyfynwy reservoir had been cleaned out, and its capacity enlarged from 50 million to 100 million gallons. This would increase the Company's storage from 100 million to 200 million gallons. The report was adopted.

An Increasing Supply in South Staffordshire.

At the half-yearly general meeting of the South Staffordshire Water Company last Thursday, the Directors reported that the number of houses laid on during the six months ended June 30 last was 1242; making the total supplied 132,299. The gross amount of water-rates was £70,117, against £67,678 in the first half of the previous year. After providing for interest on debenture and preference stock, the amount remaining for distribution, including £7249 brought forward, was £30,000; and the Directors recommended a dividend for the half year on the ordinary stock at the rate of 7 per cent. per annum. The amount of the dividend being £22,407, there would remain £7593 to the good. The Chairman (Mr. Frank James), in moving the adoption of the report, remarked that those of the proprietors who took an interest in the Company and attempted anything like a comparison of accounts would be struck by the peculiarity of the statement now presented, which, with a very few trivial exceptions, showed an all-round increase. Dealing first with the charges upon the debit side of the profit and loss account, they found that there were increased engine charges, maintenance of works, wages, salaries, commission, rent, rates, income tax, and incidental and law charges. He thought that they might deduce from these facts that the business was progressing. Engine charges showed an increase of £165; but as there had been 100 million gallons more water pumped than in the first half of last year, he thought the shareholders would see that the increase was only commensurate with the extra amount of work done. The maintenance of works account—£7495—showed an increase of £868. In a concern like theirs, having fourteen pumping and re-pumping stations, repairs must of necessity go on. The credit side of the account showed the prosperity of the undertaking. Speaking of the balances in the hands of the Company, he pointed out that they were expecting an increase in the price of coal. The supply of the Company was a pumping one, and the population dependent on them was 551,500; and as they required a large supply of coal, it was a good thing to have a balance for equalizing the dividends. Alderman Beale seconded the motion, and it was carried unanimously.

Increased Storage at Wrexham.

At the recent meeting of the Wrexham and East Denbighshire Water Company, the accounts which were presented showed a profit of £6891 on the working in the year ending the 30th of June; and a sum of £7204 was available for distribution. The Directors recommended the payment of dividends at the rates of 6½ per cent. per annum upon the consolidated stock, and 4½ per cent. per annum upon the ordinary stock, both free of tax; and this was agreed to. The large storage reservoir at Ty Mawr, the construction of which has occupied the attention of the Directors for some years past, has been so far completed as to permit the impounding of water. The need for this reservoir was unfortunately made too apparent during the summer of last year, when, owing to the prolonged drought, it became necessary to curtail the constant service to consumers. With the additional storage now provided, the total quantity of water to meet prospective requirements will be 170 million gallons, compared with 40 millions hitherto available—an increase in the Company's resources which the Directors believe will place them in a position to meet every contingency.

BARNET DISTRICT GAS AND WATER COMPANY.

The Half-Yearly General Meeting of this Company was held last Friday, at the Holborn Restaurant, W.C.—Mr. A. H. Baynes in the chair.

The Secretary (Mr. Ernest W. Drew, F.C.A.) read the notice convening the meeting; and the Directors' report and the accounts were taken as read.

The Chairman, in moving the adoption of the report and accounts, said there were a few facts in connection with the working of the past half year to which he would direct attention. Referring first to the gas department, and comparing the figures with those for the corresponding six months of 1906, the gas made showed an increase of 4,298,000 cubic feet; while the quantity sold had increased by 4,106,000 cubic feet, or rather more than 7½ per cent. The amount of coal carbonized was 5830 tons, or an increase of 416 tons; and the average make of gas per ton was 10,822 cubic feet. Of coke, there were 5552 chaldrons made, or an increase of 396 chaldrons; while the quantity sold showed an increase of 300 chaldrons. The average price realized was 9s. 6d. per chaldron, which was 9d. per chaldron more than in the preceding year. The make of sulphate of ammonia was 9 tons more; and the price obtained per ton was 3s. 1d. higher than in 1906. The gas rental during the past six months amounted to £10,753, which was an increase of £779; while the rentals of meters, stoves, and fittings showed an increase of £93. The receipts for residuals were £444 more—due mainly, of course, to the better market for coke. The total receipts of the gas department came to £14,565, which represented a gain of £1318 over the same period of 1906. Turning to the expenditure side of the gas accounts, it would be seen that there was a considerable increase; for while repairs to mains and public lighting were less by some £552, the total expenditure for the half year just closed was more by £868 than in the corresponding period of last year. This increase was chiefly accounted for as follows: Owing to the larger quantity carbonized, the cost of coal was £371 more; repairs to stoves and fittings were £166 more; rates and taxes (which had a marvellous way of rising) were £150 more; and repairs to works came to £604 more, consequent upon the alteration of the system of retorts. The Board had felt it to be the wisest policy to replace the old retort-settings, which had become out of date, by improved ones, with regenerative furnaces, from which they expected to obtain a very considerable economy in fuel and a saving of wear and tear which would soon repay the initial outlay, as well as increase the productive power. For the past half year, the total receipts for gas had been £14,565, and the expenditure £11,283, leaving a profit of £3282—or £450 more than in 1906. With regard to the water portion of the undertaking, the receipts from water rates during the past six months had been £16,647, or an increase of £990; but the expenditure was £1435 more, owing to the following reasons: Pumping charges, due to the much larger quantity of water pumped, were £404 more; wages were £270 more; rates and taxes were £420 more; maintenance of mains was £155 more; and there was £643, which was the cost of the parliamentary opposition to certain portions of the Metropolitan Water Board Bill. He thought they were to be congratulated upon the success of this opposition, as, had the Bill become law in its original form, the Company certainly might have suffered. The total profit on the gas and water portions of the business together for the half year was £11,964, from which had to be deducted interest and income-tax amounting to £2079, leaving a net profit of £9885. The sum required to pay the dividends which the Board recommended was £9434, which would leave £451 to be carried forward to the balance in hand. It was interesting to know that during the past six months the length of the gas-mains had been increased by 356 yards, and of the water-mains by 3334 yards—being a total increase of 3690 yards. The amount of water pumped into the district in the six months was 305,663,000 gallons, which was 45,519,000 gallons more than in the corresponding half of 1906. There were laid on 143 new services for gas and 336 for water. As he mentioned at the meeting six months ago, the work they had carried out at East Barnet had resulted in a largely enhanced supply of water; and the Board were at present engaged in efforts to still further augment the supply, which gave promise of being very successful. This was being done with a view of providing against every possible contingency.

Mr. Alfred Lass, F.C.A., seconded the resolution.

Mr. W. Ormandy asked what was the depth of the deepest well, and whether they were continuing to sink wells.

Mr. T. H. Martin (the Engineer and Manager) said the depth of the deepest well was about 250 feet; but there were, of course, borings below that, to about 500 feet. They were still sinking other wells, and would have to continue doing so, in consequence of the growth of the district.

Mr. Kain inquired whether there was any further prospect of litigation with the Water Board.

The Chairman said there was not. That was all over.

Mr. Kain asked whether the wells were located by the Company's own Engineer.

Mr. Martin, in reply, said they were not. He was not a geologist. Before sinking wells, the Company always took the best geological advice as to where they should go.

The resolution was then carried unanimously.

The Chairman then moved, and Mr. Frederick Lennard seconded, the payment of a dividend, less income-tax, for the half year to June 30 at the rate of 7½ per cent. per annum on the "A" and "C" stocks, 6½

per cent. per annum on the "B" stock; and 5¼ per cent. per annum on the "D" capital gas and water stocks.

Mr. SAMUEL SPENCER asked whether the excessive price of coal would be likely to interfere with the profits in the next half year.

Mr. MARTIN replied that they made their contract very early in the year, and did not suffer very much.

The proposition was then agreed to.

Mr. A. F. PHILLIPS remarked that the Company were served by a very excellent staff of officers, to whom they were much indebted. These were Mr. Martin, the Engineer, Mr. Drew, the Secretary, and Mr. Wright, who had charge of the rental department. Their anxieties during the past six months had not been less than in previous years; and he thought the balance-sheet showed they had been successful in their work. He had much pleasure in proposing a vote of thanks to them.

Mr. J. L. CHAPMAN said, as having some considerable knowledge of gas making and other engineering matters, he felt that their officers had been very successful; and their excellent work deserved acknowledgment. He therefore wished to second the motion.

The vote was accorded; and Mr. MARTIN, Mr. DREW, and Mr. WRIGHT all briefly returned thanks.

On the proposition of Mr. SAMUEL CUTLER, seconded by Mr. SPENCER, a similar compliment was paid to the Chairman and Directors; and with the CHAIRMAN'S acknowledgment, the proceedings terminated.

RIVAL GAS SUPPLIES AT DRAYCOTT.

The following remarks with regard to the gas supply of Draycott were contained in an article published in last Saturday's edition of the "Nottingham Daily Express."

An unusual, and in some respects amusing state of affairs exists at Draycott and the adjacent village of Breaston in connection with the supply of gas. Some thirty years ago, the Long Eaton Gas Company was formed, and obtained parliamentary powers to supply a somewhat extensive area, of which Long Eaton is only a comparatively small portion. No steps were taken to supply the remaining portion of this area (which includes Draycott and Breaston); and when, twenty years ago, a Gas Company was formed at Draycott, the new Company were permitted (without opposition from Long Eaton) to obtain powers to supply Breaston as well as Draycott, which they have done. Unlike many small gas concerns, the Draycott Company have supplied gas at a very reasonable figure, ranging from 2s. 6d. per 1000 cubic feet down to 1s. 6d. for gas-engines—indeed, their average price for gas has probably been the lowest in the county. This summer the Long Eaton Company have laid a 12-inch main through Breaston to Draycott, a distance of some 3 or 4 miles. They undersold the Draycott Company by offering gas at 2s. per 1000 cubic feet; and as an additional inducement, they volunteered to supply customers with free fittings. Thereupon the Draycott Gas Company reduced their maximum charge to 2s.

Such, briefly, are the events which have led up to the present situation. The results are not what one would have anticipated. Instead of Breaston and Draycott consumers expressing satisfaction at the reduction of the charge for gas, there is a very general feeling of resentment against the newcomers. Manufacturers, tradesmen, and private residents alike profess to see an ulterior motive behind the apparent concessions. They point to the fact that the price of gas in Long Eaton is 3s., less 10 per cent., and ask: "Why should the Long Eaton Company spend thousands of pounds in order to supply us with gas at a much lower figure than they charge at Long Eaton?" Not a few answer the question themselves by declaring that it is the intention of Long Eaton to crush the Draycott Company by continually underselling them. Indeed, it is alleged that a representative of the Long Eaton Company bluntly declared that, as there was not room for two Companies in Draycott and Breaston, one must go to the wall.

A prominent resident of Breaston, and a considerable owner of house and cottage property in the village, thus expressed himself to our representative: "I do not think Long Eaton will succeed in their assumed object. We have been treated well by Draycott, who have given us good gas at a fair price. Then we look at it in this way: If the Draycott Company were 'snuffed out,' the Long Eaton Company, to recoup themselves for their outlay, would probably put the price of gas up to about 4s.; for they have power to charge this district 1s. more than in Long Eaton. I do not think many here would pay the price." Continuing, he said that, as far as his tenants were concerned, he did not think any of them wished to be connected with the Long Eaton main; but even if they did, he, as the landlord, would not allow the connection to be made.

In Long Eaton itself the facts of the matter do not appear to be generally known; but, on being interviewed, several of the larger consumers considered they had just cause for complaint. They argue in this fashion: "If 3s., less 10 per cent., is a fair price to pay, leaving a reasonable margin of profit, then a considerable loss must be incurred by supplying Breaston and Draycott consumers at 2s.—a loss which sooner or later either we or the shareholders will have to pay for. On the other hand, if gas can be taken several miles away and profitably sold at 2s., then we in Long Eaton must be terribly overcharged." As for the shareholders, we understand that many of them complain that this extension was carried out, not only without their sanction, but without their knowledge; and they view the very considerable capital expenditure with misgiving, fearing that it will prove unremunerative. Already a special meeting of shareholders has been arranged for the purpose of increasing the subscribed capital of the Company; and we hear that a certain section of the shareholders propose to convene a meeting with the object of having the present results and future prospects of what they term an ill-advised extension thoroughly discussed.

Failure of Electricity at Colchester.—An accident at the electricity works last Friday caused a failure of the current which for half-an-hour left Colchester in darkness. The breakdown occurred just before eight o'clock. The trams ceased running, the cars being left in the streets where they happened to be when the current failed; and many of the shops and houses were in darkness. In recording the incident, the "East Anglian Times" remarks that the fact that the employees at the electric light works had to borrow a candle from a neighbouring hotel, constituted a distinctly humorous feature of the situation.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 620.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	20—21	..	5 0 0
268,324	10	,,	7½	Do. 7 p.c.	13¾—14½	..	5 3 5
200,000	5	May 15	7	Bombay, Ltd.	6¾—7	..	5 0 0
40,000	5	,,	7	Do. New, £4 paid	4⅜—5¼	..	5 6 8
50,000	10	Aug. 29	14	Bourne-mouth Gas and Water: 10 p.c.	27—28*	+1	5 0 0
51,810	10	,,	7	B 7 p.c.	16¼—16¾*	+1	4 3 7
53,200	10	,,	6	Pref. 6 p.c.	14¾—15¾*	..	3 17 5
380,000	Stk.	Aug. 15	12½	Brentford Consolidated	245—250	..	5 0 0
300,000	,,	,,	9½	Do. New	185—190	..	5 0 0
50,000	,,	,,	5	Do. 5 p.c. Pref.	115—120	..	4 3 4
206,250	,,	June 13	4	Do. 4 p.c. Deb.	103—103½	..	3 17 8
220,000	Stk.	Mch. 14	11½	Brighton & Hove Orig.	220—225	..	5 0 0
246,320	,,	,,	8½	Do. A. Ord. Stk.	160—165	..	5 0 0
460,000	20	Apl. 11	10	British	41½—42½	..	4 14 1
104,000	Stk.	Aug. 15	6	Bromley, Ord. 5 p.c.	116—119	..	5 0 10
165,700	,,	,,	4½	Do. do. 3½ p.c.	87—90	..	5 0 0
500,000	10	May 15	7	Buenos Ayres (New) Ltd.	10¾—11¼	..	6 4 5
250,000	Stk.	June 27	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
150,000	20	July 12	8½	Cagliari, Ltd.	26—27	..	5 17 10
100,000	10	June 13	10	Cape Town & Dis., Ltd.	11—13	..	7 13 10
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.	8—9	..	5 0 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	50—52	..	5 15 5
50,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	94—96	..	4 13 9
157,150	Stk.	Aug. 15	5	Chester 5 p.c. Ord.	106½—108½	..	4 12 2
1,143,280	Stk.	,, 29	5⅝	Commercial 4 p.c Stk.	101—106*	+½	4 18 1
560,000	,,	,,	5	Do. 3½ p.c. do.	98—103*	+½	4 17 1
475,000	,,	June 13	3	Do. 3 p.c. Deb. Stk.	81—83	..	3 12 3
800,000	Stk.	,,	6½	Continental Union, Ltd.	112—117	..	5 11 1
200,000	,,	,,	7	Do. 7 p.c. Pref.	136—141	..	4 19 3
460,170	Stk.	—	5½	Derby Con. Stk.	123—125	..	4 8 0
55,000	,,	—	4	Do. Deb. Stk.	102—104	..	3 16 11
486,090	10	July 31	12	European, Ltd.	22½—23⅜	..	5 2 2
354,060	10	,,	12	Do. £7 10s. paid	17½—18½	..	4 17 4
15,182,590	Stk.	Aug. 15	4⅛	Gas-light and Coke: 4 p.c. Ord.	93—95	+1	4 12 7
2,600,000	,,	,,	3⅜	3½ p.c. max.	86—88	..	3 19 7
3,799,735	,,	,,	4	4 p.c. Con. Pref.	102—105	..	3 16 2
4,193,975	,,	June 13	3	3 p.c. Con. Deb.	81—83	−1	3 12 3
258,740	Stk.	Mch. 14	5	Hastings & St. L. 3½ p.c.	95—100	..	5 0 0
82,500	,,	,,	6½	Do. do. 5 p.c.	116—119	..	5 9 3
70,000	10	Apl. 26	11	Hongkong & China, Ltd.	15—20	..	5 10 0
4,940,000	Stk.	May 15	8	Imperial Continental	174—176	+1	4 10 11
473,600	Stk.	Aug. 15	3½	Do. 3½ p.c. Deb. Red.	91—93	..	3 15 3
195,2.2	Stk.	Aug. 29	6	Lea Bridge Ord. 5 p.c.	110—120*	+3	5 0 0
300,083	,,	June 27	4	L'rpool Unit'd Deb. Stk.	108—110	..	3 12 9
£			p.c.				£ s. d.
561,000	Stk.	Aug. 29	10	Liverpool United A	217—219*	..	4 11 4
718,100	,,	,,	7	Do. B	160½—16 1½*	..	4 6 8
152,736	Stk.	Feb. 14	7⅞	Maidstone 5 p.c.	142—147	..	5 3 8
75,000	5	June 27	5	Malta & Metin., Ltd.	4—4½	..	5 11 1
560,000	100	Apl. 2	5	Met. of 5 p.c. Deb.	100—102	..	4 18 0
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	May 30	3½	Monte Video, Ltd.	10½—11½	..	6 1 9
1,775,892	Stk.	Aug. 15	4⅜	Newc'tle & G'tesh'd Con.	107—108	..	4 5 7
406,025	Stk.	June 27	3½	Do. 3½ p.c. Deb.	90—91	..	3 16 11
15,000	10	Aug. 29	10	North Middlesex 10 p.c.	19—20*	..	5 0 0
55,940	10	,,	7	Do. 7 p.c.	12½—13½*	..	5 3 8
300,000	Stk.	Apl. 26	8	Oriental, Ltd.	140—145	..	5 10 4
60,000	5	Mch. 27	7	Ottoman, Ltd.	6—6½	..	5 7 8
398,490	5	May 15	7	Primitiva Ord.	6⅜—7¼	..	4 16 7
796,980	5	July 31	5	Do. 5 p.c. Pref.	4⅜—5⅛	..	4 17 7
488,900	100	June 1	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
1,000,000	10	Apl. 26	8	River Plate Ord.	13—13½	+¼	5 18 6
312,650	Stk.	June 27	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
250,000	10	Mch. 27	8	San Paulo, Ltd.	13—13½	+¼	5 18 6
125,000	50	July 1	5	Do. 5 p.c. Deb.	48—50	..	5 0 0
135,000	Stk.	Mch. 14	10	Sheffield A	246—248	..	4 0 8
209,984	,,	,,	10	Do. B	246—248	..	4 0 8
523,500	,,	,,	10	Do. C	246—248	..	4 0 8
70,000	10	June 13	10	South African	15—16	..	6 5 0
6,429,895	Stk.	Aug. 15	5⅓	South Met., 4 p.c. Ord.	118—121	+½	4 10 11
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	81—83	..	3 12 3
201,720	Stk	Mch. 14	8	South Shields Con. Stk.	159—161	..	4 19 5
605,000	Stk.	Aug. 15	5½	S'th Suburb'n Ord. 5 p.c.	115—118	..	4 13 3
60,000	,,	,,	5	Do. 5 p.c. Pref.	117—120	..	4 3 4
117,058	,,	July 12	5	Do. 5 p.c. Deb. Stk.	120—125	..	4 0 0
502,310	Stk.	May 15	5	Southampton Ord.	105—110	..	4 10 11
120,000	Stk.	Aug. 15	6¾	Tottenham and 5 p.c.	120—123	..	5 9 9
398,940	,,	,,	5¼	B 3½ p.c.	100—103	+2	5 1 11
149,470	,,	June 27	4	Edmonton 4 p.c. Deb.	99—101	..	3 19 3
182,380	10	June 13	8	Tuscan, Ltd.	10¼—10⅝	..	7 8 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	100—102	..	4 18 0
193,742	Stk.	Aug. 29	5	Tynemouth 5 p.c. max.	107—109*	+2½	4 11 9
30,000	Stk.	Feb. 14	8	Wandsworth A 5 p.c.	—	..	—
255,636	,,	Aug. 15	6½	B 3½ p.c.	128—133	..	4 17 9
75,000	,,	,,	5⅝	and C 3½ p.c.	—	..	—
80,075	,,	June 27	3	Putney 3 p.c. Deb. Stk.	77—80	..	3 15 0
845,872	,,	Aug. 15	5⅛	West Ham 5 p.c. Ord.	101—104	+2	4 18 6
185,000	,,	,,	5	Do. 5 p.c. Pref.	118—120	..	4 3 4
228,300	,,	June 27	4	Do. 4 p.c. Deb. Stk.	100—103	..	3 17 8

Prices marked * are "Ex div."

THE GASHOLDER QUESTION AT ELGIN.

Gas affairs in Elgin again require some attention. The Town Council met yesterday week, when the Town Clerk reported regarding the inquiry before Sheriff Wilson as to the site of the proposed gasholder (*ante*, p. 581), and stated that it had been agreed, in terms of a suggestion by the Sheriff, that a conference be held with the objectors. The conference took place last Wednesday, in the Burgh Court House—Provost Christie presiding. The Provost gave a narrative of the proceedings which led up to their choosing the site at North Lodge, where they owned land which they acquired when they erected the common lodging-house. The Council, he said, had not been able to find a better site than the proposed one. It was surrounded mostly by gardens. There were in the neighbourhood various works; and the narrow lane was never likely to be used for dwelling-houses. He admitted that a few houses would have their views obstructed, particularly that of Dr. Mackay; but wherever they would propose to place the holder, somebody would object. The Town Clerk read letters from Mr. John Munro, objecting strongly to any extension of the works on Lossie Green. Mr. E. D. Jameson, Solicitor, on behalf of the objectors, thanked the Council for agreeing to meet them as suggested by the Court; and he hoped that the result of their meeting would remove the difficulties they were face to face with. The objectors were quite alive to the many difficulties the Town Council had to contend with; but they did not think the difficulties were insuperable. One point which should be kept carefully in view was the present leakage of gas; and in connection with this matter he did not think their friend the Gas Manager was in any way responsible. He had only been a few years in his present position; and this had been going on for many years. In fact, years ago it had drawn comment from the Auditor. It was well known that the whole system of piping was in a sadly deficient state, with the exception of pipes which the Council had relaid or repaired. The leakage was not equalled in any town in Scotland. A wastage of 21 per cent. was a state of matters which should not be allowed to continue. He estimated the annual loss to the town by leakage at £1000; and if this matter were properly attended to by the Council, he believed they would get over all their difficulty for the present, and it would give them time for consideration and negotiation. This brought him to his first point—that the present proposals of the Council were unnecessary. They appeared to the objectors to be a little extravagant. They were rushing from one extreme to the other. At the present time, their storage capacity was only 80,000 cubic feet; and they now proposed to make it 280,000 cubic feet. This surely on the face of it required a little more consideration. It seemed a pity that the Council should embark on a retrograde policy, and depreciate a neighbourhood, which had been greatly improved within the past few years. They were not there without being prepared to suggest a remedy. Of course, if the gasholder were not put where it was proposed, the only other site was Lossie Green, unless they removed the gas-works altogether. There was no doubt that was the ideal policy to adopt; and, in doing so, if they kept in view the large saving which might be judiciously effected in connection with the present excessive waste of gas, this sum alone would go a long way to help towards the better policy of removing the works. Apart from this, however, they thought the Lossie Green site should be adopted in preference to the North Lodge site. The legal difficulty that the green was held for public recreation ground was not insuperable. An application for a Provisional Order to acquire a small piece of ground there would, he had no doubt, be successful. Apart from this, if they adopted the policy of doing away with the Gas Manager's house and the small holder, they would have sufficient room inside the present works to erect a holder with a storage capacity of 160,000 cubic feet, which, with the present one, would give a total capacity of 240,000 cubic feet, or three times the present storage. The Provost pointed out that Mr. Jameson took the whole of the waste gas into consideration; but it was well known they could not carry on a gas undertaking without a certain amount of loss. The lowest waste in a town the size of Elgin was about 10 per cent. If the holder for the proposed capacity were erected inside the works, its height would be 80 feet. Mr. Jameson produced an estimate from a firm of builders in which the height was stated to be only 60 feet. With regard to the leakage, he said that if they only took half, and not the whole, of it, into consideration, it would greatly help them. After discussion, Provost Christie said the Council would meet and give very careful consideration to the suggestions which had been made. The Town Clerk and Mr. Jameson were authorized to draw up a minute to Sheriff Wilson asking him to defer his judgment in the matter. A man from Aberdeen has been selected by the Committee for finding out gas leaks and testing meters.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The accounts of the gas department of the Corporation of Aberdeen for the year ending July 31 have been issued. They show a total revenue of £112,747—an increase of £123 over the previous year. Gas and meter rents amounted to £89,528; made up of £73,989 from ordinary consumers; £6261 from motive power; £9251 through prepayment meters; and from meter-rents, £27. The total revenue from gas was £635 less than in the preceding year, due to a reduction in the price of gas last year by 2d. per 1000 cubic feet. There was realized from residual products £20,597, compared with £20,467; from house services, £1100, against £1328; from gas-stoves, £1388, compared with £553; and from rents and feu-duties, £129, as compared with £104. The total revenue was £124 greater than in the previous year, and £313 more than in 1905. The expenditure amounted to £92,950, the principal item of which was coal, which cost £54,925, as against £51,376. Purifying materials (less £200 received for waste lime and spent oxide) cost £1891; salaries and wages amounted to £12,841;

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No. 6.

MR. J. D. ASHWORTH, Engineer and General Manager, PORTSMOUTH GAS COMPANY, writes:—

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maintenance of works, £684, and of plant, £3950. The total cost of the manufacture of gas was £74,830, as compared with £73,346. The distribution of gas, including wages of meter inspectors, cost £1575; repairing and refixing meters, £1030; and repairs and maintenance of main and service pipes (laying, paving, and labour, £990), amounted to £3596, as compared with £3718. House services cost £962, as against £1140; and gas-stoves (in respect of which £779 was written off for depreciation) cost £1388, as compared with £553. Rents, rates, and taxes amounted to £5588, as against £6486; management cost £1949, as compared with £1891; general charges amounted to £892, as compared with £780; and discounts and bad debts to £3743; as compared with £3719. The total expenditure was £913 greater than in the previous year. The net profit for the year was £19,795, compared with £20,585 the previous year, and £19,736 in 1905. Out of the net profit there fell to be paid —annuities, £4137; interest on mortgages, bank account, reserve fund, £4518; to be placed to sinking fund for the redemption of mortgages, £9780; for redemption of gas annuities, £650; and to reserve and insurance funds, £300; leaving a balance of £6386 to be carried to the current year's account. Capital expenditure during the year amounted to £3320, raising the capital account, with funds and stocks on hand, to £374,842. The quantity of coal carbonized was 70,010 tons; and the average price of it was 15s. 5½d. per ton. The quantity carbonized the previous year was 68,414 tons. Gas made amounted to 725,301,000 cubic feet, as compared with 691,306,000 cubic feet. Gas sold amounted to 692,265,000 cubic feet, an increase of 34,094,000 cubic feet. Gas unaccounted for amounted to 35,036,000 cubic feet, equal to 4·83 per cent., as compared with 5·08 per cent. the previous year. The average yie'd or gas per ton of coal was 10,211 cubic feet. The prices of gas were 2s. 7d. for lighting, and 2s. 4d. for power. Bad debts amounted to £334. The Gas and Electricity Committee met yesterday and approved of the accounts. They also adopted estimates for the current year, according to which the revenue is expected to be £114,528, and the expenditure £122,670. The greatly increased price of coal—now 18s. 2d. per ton—will entail an extra outlay equal to 3d. per 1000 cubic feet; but the Committee resolved to recommend that the prices of gas should remain unchanged for this year.

In the Greenock Town Council last week, it was reported that the quantity of gas sold during the previous month amounted to 14,616,000 cubic feet—a decrease of 124,000 cubic feet as compared with the corresponding month of last year. The average yield per ton of coal was 9632 cubic feet. The quantity of coal used was 1497 tons, as against 1231 tons. Mr. Forbes, in moving the adoption of the minutes of the Gas Committee, said it appeared that less gas had been made per ton of coal than was made in the same period of last year, but this was due to the erratic working of the station meter. They were also being credited with a larger amount of leakage than there actually was. It was proposed to hold an exhibition of gas appliances, and that the gas department should bear the cost of the exhibition. Bailie Bennett moved an amendment to the proposal to bear the cost of the exhibition. They were all agreed, he said, that every effort should be made to increase the sale of gas-cookers and similar appliances, but he thought it ought to be done on business lines. In a discussion which followed, it was stated that local tradesmen would be asked to take part in the exhibition, that heating and lighting appliances would be exhibited by them, but that, if they wished, they could exhibit cookers. On a division, the minutes were adopted by 19 votes to 5.

Before the advent of the cinematograph for the illustration of passing events, the high-water mark in the world of pictorial illustration was the dissolving view, in which the one still view melted into the other. This dissolving view—some might call it the chamelion view—is well exemplified by the position of Treasurer Young, of Musselburgh, at the present time. The Town Council, of which, of course, Mr. Young is a member, welcomed to the town one of those all-absorbing, thoroughly unselfish companies vending electricity for power and lighting. They allowed one of these companies to run a tramway into the town, and to take over the lighting of some of the streets of the burgh. The Company, not so great philanthropists after all as certain wide-o'-gapes imagined, wanted to earn aid vidend on their outlay. They could not squeeze the Corporation, and so the trouble they have had has been with their employees on the tramway system. A strike of these employees has been in existence for several weeks now, upon the question of payment for extra hours. One of the most prominent supporters of the strikers has been Treasurer Young, who has been instant, in season and out of season —even to addressing open-air meetings—in support of their cause. At one of these open-air meetings the other night, Mr. Young, in support of an argument in favour of the strikers, urged the electors of the town to return to the Town Council men who would be pledged to revert from electricity to gas for public lighting, at the end of the two years' contract. If they did so, he said, they could acquire the tramway and the lighting concern for an old song. He would be the last to advocate returning to gas from electric light, but the Company [the Electric Company] he declared had been so unreasonable that he was prepared to make any sacrifice necessary to defeat them. I am not desirous of entering into a discussion upon the ethics of municipal finance in Musselburgh; but it lies upon the surface of the question that when the Corporation entered into the bargain with the Electric Company, their desire was to get below the local Gas Company in the matter of lighting. That they have not altogether succeeded is apparent; but the blindness of at least one of their number is made manifest by his remark about "sacrifice" in returning to gas lighting. If he knew what he was talking about, instead of "sacrifice" he would speak of "profit" in returning to gas lighting; but then the colour of the coat of certain public men must be made to suit their environment, other considerations being left out.

It is announced that owing to the largely increased demand for gas at Ecclefechan, it has been found necessary to duplicate the entire plant at the gas-works, and that it is anticipated that the work will be completed by the end of September. The gas-works are private property, and the gas supplied is produced by one of the processes which are worked with some of the lighter oils.

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CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia. LIVERPOOL, *Aug.* 31.

Improved demand has been sustained all through the week, and supplies have been absorbed as they have become available; but there has been no decided improvement in values, though in urgent cases extreme prices have been paid. The closing quotations are £11 16s. 3d. per ton f.o.b. Hull, £11 18s. 9d. per ton f.o.b. Liverpool, and £12 per ton f.o.b. Leith. There has been more doing in the forward position, but the extreme firmness of the large makers tends to check business. For September-December delivery £12 per ton f.o.b. Liverpool has been paid, and £12 2s. 6d. per ton, f.o.b. Leith, for November-April; and at the close an advance of 2s. 6d. per ton on these prices is being quoted.

Nitrate of Soda.

This market remains without alteration—quiet but steady. Spot prices are 11s. 1½d. per cwt. for 95 per cent., and 11s. 4½d. for refined quality.

Tar Products. LONDON, *Sept.* 2.

Markets are still quiet, and prices fairly steady. In pitch, there is decidedly more disposition among manufacturers to reduce their prices to the level of dealers' ideas for delivery during the present year. On the east coast 26s. 6d. has been accepted to the end of the year; while from ports where high rates of freight obtain, distillers have offered their make at this figure without success. Manchester and Liverpool makers appear to be rather better sold, and refuse to make offers; while the west coast generally are fairly firm in their ideas. Continental buyers are still holding off. South Wales are declining nearly all business for this year's delivery, and report having bought very cheaply all over 1908. Creosote is very steady. The large London makers decline to sell in most cases; but some business has been done at 2⅞d. to 2¾d. The Midlands are very firm, and quote from 3d. to 3⅛d.; while in the North, makers are asking from 2⅞d. to 2⅞d., according to quality and place of delivery. Benzol 90 per cent., benzol 50-90 per cent., and toluol are all very quiet, and business is still reported at low figures. For delivery all over 1908, 90 per cent. has been sold at very little over prompt prices. Solvent naphtha is quiet in the country, but fairly steady in London, where London makes are still in fair demand. Carbolic is steady, though Continental manufacturers refuse to bid more than 1s. 8½d., east coast; but dealers are paying rather over this to the manufacturers. Crystals are quiet, with little business doing. Salts are in good demand at fair prices.

The average values during the week were: Tar, 15s. 3d. to 19s. 6d. Pitch, London, 26s. nominal; east coast, 25s. 6d. to 25s. 9d.; west coast, 24s. to 25s. Benzol, 90 per cent., 8d. to 8¼d.; 50-90 per cent., 8½d. to 9½d. Toluol, 10½d. to 11½d. Crude naphtha, 4d. to 4¼d.; solvent naphtha, 1s. 0½d. to 1s. 2½d.; heavy naphtha, 1s. 0½d. to 1s. 2d. Creosote, London, 2¾d.; North, 2⅝d. to 2⅞d. Heavy oils, 3d. to 3¼d. Carbolic acid, 60 per cent., 1s. 8½d. Naphthalene, £6 10s. to £12 10s.; salts, 35s. to 40s. Anthracene, "A" quality, 1½d. to 1⅝d.

Sulphate of Ammonia.

This article remains steady, but dealers still decline to improve their bids, and are evidently filling their requirements at the existing figures. The principal London Gas Companies are well sold, and their quotations are rather above the market. Ordinary makes are fetching about £11 11s. 3d. to £11 12s. 6d. on Beckton terms, and £11 16s. 3d. to £11 17s. 6d. f.a.s. terms. In Leith, ruling figures are about £12 for prompt, and £12 2s. 6d. for forward delivery, though in most cases makers are asking 2s. 6d. over these figures. Hull is quiet at £11 13s. 9d. to £11 15s.; and Liverpool is steady at £11 16s. 3d. to £11 17s. 6d.

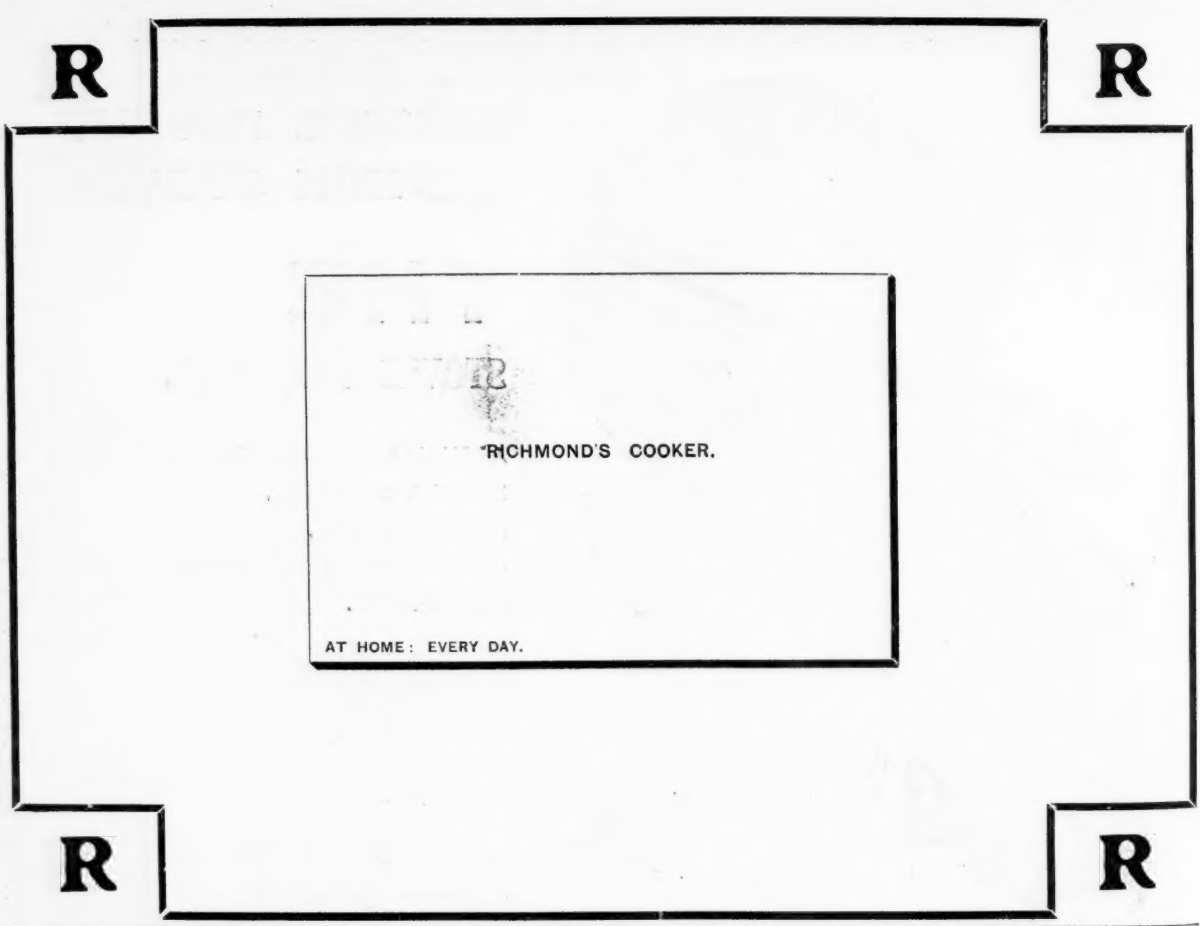
COAL TRADE REPORTS.

Lancashire Coal Trade.

Beginning with yesterday, the prices of house fuel and slack were officially advanced; the former 1d. per cwt., or 1s. 8d. per ton, and the latter 10d. per ton. The state of trade fully warrants this advance. All through the summer both home and foreign demands have been far above the average. All new contracts are dearer, and there is no prospect of relief to consumers. In June, 1906, the coal exported from this country totalled 4,265,817 tons; in July of the same year, the quantity was 5,027,162 tons. Last June the figures were 5,321,093 tons, and in July 6,098,663 tons. In consequence of these increased exports, coupled with the rise in prices, passenger rates on outward bound steamers are being advanced. Average quotations on the Manchester Coal Exchange are as follows: Best house coal 16s. to 17s. 2d., secondary 14s. to 15s., common 12s. to 14s., burgy 10s. 6d. to 11s. 2d., best slack 9s. 6d. to 10s. 4d., medium 8s. 6d. to 9s., lower qualities 7s. 9d. to 8s. 4d. Coal for export is 13s. to 14s. 6d. Furnace coke 18s. to 24s.

Northern Coal Trade.

There is a very strong demand for coals, the exports being heavy and the home consumption showing an increase, while the tendency of prices is now again upwards. In the steam coal trade, there is some pressure, which is likely to increase as the time draws near for the end of the Baltic trade. Best Northumbrian steam coals are 16s. 6d. to 16s. 9d. per ton f.o.b. For second-class steams, the quotation is from 15s. 9d. to 16s., and steam smalls are from 10s. to 10s. 6d.; the latter kind being rather more abundant. In the gas coal trade, the demand is now increasing for home use, and there are also heavy foreign shipments; so that the production is well taken up, and there is some scarcity of the best classes of coal for prompt shipment.



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Durham gas coals vary from about 14s. to 15s. 6d. per ton f.o.b., with 3d. per ton more for the best kinds. In contracts, the quantities are not heavy; but where the delivery is over the winter, the prices are very high—in one or two instances higher than for half-a-dozen years. At the same time, it is believed that some second-class gas coals have been sold, for delivery over next year, at about 12s. 10½d. per ton f.o.b. —the quantity being given at about 40,000 tons. Coke is very firm, generally, and gas coke is steady, even with the larger production that is now made. Good gas coke is from 19s. 6d. to 20s. per ton f.o.b. in the Tyne.

Scotch Coal Trade.

Trade continues very active, and the cry of the market is still that the increased prices come, but those who discern believe that the tide is on the turn. The high figures ruling here are leading to larger productions in foreign pits, and the high wages earned in pits at home are attracting shoals of labour. This will soon lead to larger outputs, after which prices will come down. A leading authority has given out that the present high prices will not live beyond a few months. The quotations are: Ell 14s. 6d. to 16s. 6d. per ton f.o.b. Glasgow, splint 14s. 6d. to 15s., and steam 13s. 6d. to 13s. 9d. The shipments for the week amounted to 340,050 tons—an increase of 31,527 tons upon the previous week, but a decrease of 29,136 tons upon the corresponding week of last year. For the year to date, the total shipments have been 9,436,458 tons—an increase of 589,766 tons upon the corresponding period of 19[illegible].

Sale of the Bridgend Electric Power Station.

At the meeting of the Bridgend District Council last Tuesday, the Chairman (Mr. R. C. Griffiths) made a statement regarding the negotiations which have been proceeding for some time between the Council and the South Wales Electrical Power Distribution Company, Limited, for the purchase by the Council of the Company's generating station at Bridgend. Reviewing the negotiations, Mr. Griffiths stated that first of all the Council entered into an agreement with the Company indemnifying them against any loss sustained in continuing to work the station, which had cost no less than £38,700 to erect and equip; and the Council had now agreed to purchase it for £5000. They had also secured favourable terms from the ground landlord for a reduced rent; and the Committee of the Glamorgan County Asylums, who were the largest consumers of power from the station, had agreed to take energy for lighting at 3d. per unit, and for power purposes at 1½d., against 1⅜d. paid to the Company. The Council were advised that £1500 would be sufficient to provide the necessary stock-in-trade; and an application was being made to the Local Government Board for permission to borrow £6500. In this was included the estimated cost of obtaining a Provisional Order for supplying the extended area of the Bridgend district and the asylums.

Hereford Ironmongers and Gas-Fitters and the Gas Committee.—A short time ago the Gas Committee of the Hereford Town Council issued a circular to householders in the city notifying their willingness to undertake the maintenance of consumers' incandescent gas-lights. Thereupon a memorial was drawn up, signed by twelve of the principal ironmongers, plumbers, and gas-fitters, and presented to the Council, pointing out that the new departure was a serious attack upon the tradesmen of the town supplying gas-fittings and accessories, inasmuch as it set up unjustifiable competition with them as ratepayers. The matter came before the Town Council on the 6th ult., and was referred to the Gas Committee (see *ante*, p. 456). Their report has not been officially made public; but the "Ironmonger" says it is understood that, in deference to the representations made, the scheme will be abandoned.

New Joint-Stock Companies.—The Thurles Gas Company, Limited, has been registered with a capital of £7000, in £1 shares, to acquire and continue the business of gas manufacturers, now carried on by Messrs. Robert Bruce Anderson and George William Anderson, in Thurles, Co. Tipperary, under the title of the Thurles Gas Company. The Longwith Bye-Product Company, Limited, with a capital of £41,000, in £100 shares (400 being participating preference shares), is to adopt agreements (1) with the Sheepbridge Coal and Iron Company, Limited, and (2) with the Power Gas Corporation, Limited, to acquire land, and erect thereon gas-producer plant, bye-products recovery and chemical works, &c. There will be no initial public issue. The Neilston Gaslight Company, Limited, was registered in Edinburgh last week, to take over an existing private Company. The capital is £4000, in £1 shares, for which the public are not invited to subscribe. The Lighting and Heating Trust Company, Limited, has been registered with a capital of £10,000, in £1 shares, to carry on, assist in, and promote lighting, heating, and other industries and undertakings, hold, deal in, and convert shares and securities, and for similar purposes. There will be no initial public issue.

Coal in Kent.—At the statutory general meeting of the East Kent Colliery Company last Wednesday, the Chairman (Mr. Arthur Burr) said it was only in March last that the Tilmanstone Colliery came into the possession of the Company. He asked Mr. Griffith, their certificated Manager, to carry the pit as deep as could be done consistent with safety, before stopping to do the necessary bricking up. At 707 feet progress was suspended in order to brick up to a depth of 500 feet. By Saturday, or Monday at the latest, this work would be completed and the sinking resumed. Knowing the character of the strata to be passed through, he felt quite comfortable as to the future. By January or February next they would be down to 1150 or 1250 feet into the first seam of coal; and they would then comply with the request of their critics to put coal of a high quality on the bank of the colliery. He had always felt convinced that when they reached this stage in their operations, no difficulty would be found in obtaining all the capital wanted for carrying on developments in the south-east of England as fast as labour and machinery could do the work. Mr. G. Humphrey, in seconding the motion for the adoption of the report, said that, from what he saw during a visit to the property, he was fully convinced that the statements of the Manager would be borne out by results in the near future.

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NOTTINGHAM.

Suicide by Gas.—Thomas Parrott, aged 78, a manufacturing confectioner, of Poole, was found dead in bed last Saturday week, asphyxiated by gas; and the Coroner's Jury who investigated the occurrence returned a verdict to the effect that deceased died from inhaling coal gas while temporarily insane. It was stated that he was greatly worried about business matters; and that when found, one end of an india-rubber tube was near his mouth, and the other end was fitted to a gas-tap which was turned full on.

Price of Gas at Wisbech.—The report adopted at the half-yearly meeting of the Wisbech Lighting Company stated that, in consequence of the improvements which had been recently made in the plant at the Company's works, and the economies thus effected in management, the Directors were enabled to further reduce the price of gas to the consumers. The price to be charged from July 1 last would be 3s. per 1000 cubic feet net for ordinary purposes, and for users of motive power 2s. 9d. per 1000 cubic feet net.

Ottoman Gas Company, Limited.—At the half-yearly meeting of the Company next Tuesday, the Directors will report that the gas-rental for the six months ending June 30 amounted to £14,802, whereas for the corresponding period of last year it was £13,260. The net profit is £3187, against £2991 for the first six months of 1906. The amount standing at the credit of the profit and loss account is £9422. The Directors recommend the payment of a dividend at the rate of 7 per cent. per annum on the preference shares, less income-tax, and at the same rate on the ordinary shares, tax free; leaving a balance of £6823 13s. 10d. to be carried forward.

The Gas-Works for Santa Cruz.—With reference to the paragraph on this subject which appeared recently (see *ante*, p. 519), we learn from the report of Mr. J. E. Croker, the British Consul at Teneriffe, that to carry out the contract a limited Company was formed in Bremen, with a capital of £42,500, consisting of 500 ordinary and 350 preference shares of 1000 marks each. The concessionary rights were transferred to this Company, who afterwards placed in the hands of the original holder of the concession the order for the erection of the works. This began in February last, and will be completed, it is believed, by the end of the year.

Stealing from Gas-Meters at Wallsend.—At the Wallsend Petty Sessions a short time ago, James Anderson, 27, a labourer, of no fixed abode, was charged with having stolen money from slot gas-meters. Evidence having been given by inspectors of the Walker and Wallsend Union Gas Company as to the meters having been tampered with and pennies extracted, Inspector Pringle stated that the accused had lived by stealing from gas-meters in the town; there having been twenty robberies similar to those with which he had been charged. Accused pleaded guilty, and said he had been "very hungry the last two or three weeks." He was committed to prison for a month on each of two charges—one sentence to follow the other.

Woking Water and Gas Company.—At the half-yearly meeting of the Company yesterday, the Directors reported that the balance at the credit of the profit and loss account for the six months ending the 30th of June was £4528, out of which they recommended the payment of a dividend at the rate of 4½ per cent. per annum, less income-tax, which would absorb £3596, and leave £932 to be carried forward. The revenue amounted to £7967, and the expenditure to £3081; leaving a balance of £4886. During the half year, 131 house and 21 meter connections were made; and in the same period the mains were extended about 6497 yards. Sir John Wolfe-Barry, who was appointed sole Arbitrator for the settlement of the terms of purchase of the saleable portion of the Company's water undertaking within the extended borough of Guildford, awarded, as already mentioned in the "JOURNAL," £46,900 as the price to be paid the Company. The amount has not yet been received; but the Company are informed that application has been made for the Local Government Board's sanction to borrow the required money. The Directors are urging the Guildford Corporation to discharge their liability with the least possible delay.

Tarring of Roads in Kent.—In his third annual report to the Kent County Council upon the maintenance and repair of the rural main roads directly maintained by his department, Mr. H. P. Maybury, the County Surveyor, says that during the year 99,500 gallons of tar were purchased and used in treating the main roads through populous places—all such work being an entirely new charge. Some 53 miles of surface directly maintained by the Council was tar painted at a cost of upwards of £4000, in addition to which contributions have been made for similar work undertaken in urban districts. It may be, he remarks, that this tar-painting work is a preservative to the road; and he hopes some benefit may be derived from it. "As a dustlayer, tar, properly applied, is," he adds, "most effective, and will be largely used in future. The residents in rural districts suffer much more from the dust nuisance than do those in urban areas, because much greater speed is obtained by motors in the former; while in the latter street watering is almost general. The high-speed traffic has a prejudicial effect upon the road surfaces; and as at least 60 per cent. of the cars are now fitted with armoured tyres, much greater damage is caused than formerly."

Conviction for Theft of Gas.—At the Greenwich Police Court last Tuesday, before Mr. Rose, Henry George Ratcliff was charged with stealing a quantity of gas, the property of the South Suburban Gas Company. The accused, a plumber and gas-fitter at one time in the employ of the Company, was caretaker at No. 10, West Hill, Sydenham, from which the gas had been cut off in June last year. On the 17th ult., one of the Company's meter inspectors, accompanied by a detective, visited the house, and found that a connection had been made with the pipe from the main, so that a supply of gas could be obtained for cooking purposes; in fact, a jet of gas was burning at the time. Ratcliff admitted having taken 3000 cubic feet of gas. He said he was very sorry for what he had done; but poverty had caused him to steal the gas. He was willing to pay for what he had taken. Evidence having been given, accused was asked by Mr. Rose what he had to say in answer to the charge. He replied that he was very sorry; and had he not been so hard pushed by poverty he would not have done what he did. His Worship pointed out that he had a trade in his hands, and had misused his knowledge and systematically stolen the gas. He must commit him to prison for six weeks.

"CROWN" COOKER

Supplied, if required, with GAS AND AIR REGULATOR.

PARKINSON'S

No. 840 LANTERN.

Wind-Proof and Perfect Ventilation.

Write for Particulars—

PARKINSON AND W. & B. COWAN, LTD.
(PARKINSON BRANCH),
COTTAGE LANE, CITY ROAD, LONDON.
BELL BARN ROAD, BIRMINGHAM.

At a sale by auction last Wednesday, some original £10 shares in the Hyde Gas Company realized £25 1s. each; a few new ordinary shares fetching £18 and £18 1s. apiece.

The Directors of the British Gaslight Company, Limited, recommend a dividend at the rate of 10 per cent. per annum, free of income-tax, for the six months ending the 30th of June.

Messrs. T. & E. Wannbacher and Co., of Basinghall Street, E.C., have sent their special catalogue of sluice-valves suitable for water, gas, and steam. It furnishes full particulars in regard to dimensions and prices.

The Carron Company are issuing a neatly-printed pamphlet giving illustrations and particulars of their new gas-heated steam radiators and condensing gas-stoves. The radiators are designed for places where the ordinary stoves or coal fires are not applicable, and are made in three heights.

The Directors of Stewarts and Lloyds, Limited, recommend the payment of dividends at the rate of 6 per cent. per annum on the preference shares, and 9 per cent. per annum on the ordinary shares. The interim dividend on the ordinary shares at this time last year was also at the rate of 9 per cent.

The Richmond Gas Stove and Meter Company, Limited, held last Friday the half-yearly conference of their representatives at their London Offices and Show-Rooms. Mr. H. M. Thornton presided. In the evening, the representatives were entertained at dinner by the Directors of the Company.

The Directors of the Douglas Gas Company announce, in their half-yearly report, that the increase in the cost of coal renders it necessary for them to add 1d. per 1000 cubic feet to the price of gas. They protest against the agitation which has led the Town Council to demand arbitration on the question of the charge made for the public lighting of the town.

In order to meet the increasing demand for the "Bland" inverted burner, Messrs. Bland and Co. advise us that they have opened new offices and show-rooms at 20, Fennel Street, off Corporation Street, Manchester. In London, new offices and warehouse have been opened at 29, Little Trinity Lane, E.C.; but the show-rooms are still at 63, Queen Victoria Street.

Last Sunday week, there was some excitement at Hull, in consequence of the fusing of an electric light cable in a street-box, by which a shop-front was damaged. The fire brigade was summoned; but its services were not required, as the current was promptly cut off. The accident resulted in a partial failure of the electric light, by which inconvenience was caused at several places of worship.

As several German makers of gas-engines have now expressed approval of the proposal to establish a combination for this branch, negotiations with this object in view have been resumed. According to the "Ironmonger," a conference on the subject is to be held in the middle of this month, and the hope is entertained that it will then be possible to arrive at some understanding, and to draw up an agreement, which will probably take the form of a price convention.

LEAFLETS FOR DISTRIBUTION.

"ILLUMINATING TRUTHS FOR HOUSEHOLDERS."

No. 1.—"The Sanitary Aspects of Gas and Electric Lighting."
No. 2.—"The Cleanliness of Illuminants: The Eyesight."
No. 3.—"Fire Risks."
No. 4.—"The Relative Cost of Gas and Electricity, and Matters affecting it."
No. 5.—"On Reliability, with Instances of Misplaced Confidence."
No. 6.—"On Shop Lighting, with Special Reference to the Flame Arc Lamp."

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.
Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.
ENGINEER (New Zealand). No. 4825. Applications by Sept. 17.
WORKING MANAGER. No. 4816.
SHOW-ROOM ATTENDANT (Man and Wife). Heywood Gas-Works. Applications by Sept. 17.
SULPHATE MAKER. No. 4828.
GENERAL FITTER. No. 4829.
GAS-FITTER. No. 4830.

Gas Literature Wanted.
L. P. LOWE, 1214, Polk Street, San Francisco.

Situations Wanted.
REPRESENTATIVE (GAS AND WATER). No. 4813.
WORKING MANAGER. No. 4832.

Partnership and Management.
GAS ENGINEER'S BUSINESS. No. 4817.
No. 4831.

Sulphate of Ammonia Plant.
REPAIRS WANTED.

Plant, &c., for Sale.
GAS-LAMPS. No. 4826.

Patent for Sale.
INTENSIFIED GAS-LAMP. No. 4827.

Company Meeting.
OTTOMAN GAS COMPANY. Offices. Sept. 10, One o'clock.

Stocks and Shares.
GREAT YARMOUTH GAS COMPANY. Sept. 26.

TENDERS FOR

Coke.
LEIGH-ON-SEA GAS-WORKS. Tenders by Sept. 17.

Cast-Iron Pipes.
PLYMOUTH CORPORATION WATER-WORKS. Tenders by Sept. 19.

Gas Oil.
ROCHDALE CORPORATION. Tenders by Sept. 18.

Sluice Valves, &c.
PLYMOUTH CORPORATION WATER-WORKS. Tenders by Sept. 19.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."
United Kingdom: One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.
Payable in advance. If credit is taken, the charge is 25s. a year.
Abroad (in the Postal Union): £1 7s. 6d., payable in advance.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.
Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

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O'NEILL'S OXIDE
For GAS PURIFICATION.
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SPENT OXIDE PURCHASED IN ANY DISTRICT.

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PALMERSTON HOUSE,
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WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 54 & 47, Westminster Bridge Road, LONDON, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS, AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 254 Oldham, and 2412 HOP, London.
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SPENT OXIDE PURCHASED IN ANY DISTRICT.

THE First Dutch Bogore Co., Ltd.,
HOLLAND.
General Manager (for England and Wales)—
CHARLES E. FRY, LEAMINGTON,
General Manager (for Scotland)—
J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

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SPENT OXIDE PURCHASED.
BALE'S FIRE CEMENT.
PAINT FOR GAS-WORKS
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SULPHURIC ACID.

SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.
SPENCER CHAPMAN & MESSEL, LTD.,
with which is amalgamated WM. PEARCE & SONS, LTD.
36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, LONDON."
Telephone: 341, AVENUE.

ROBERT DEMPSTER & SONS, Ltd.
Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, Rose Mount Iron-Works, Elland.

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.
Brotherton and Co., Ltd., Chemical Manufacturers. Works: Birmingham, Leeds, Wakefield, and Sunderland.

TEMPERLEY TRANSPORTERS
FOR Rapid and Economical Handling of Coal and Coke in Gas-Works.
Next Illustrated advt. will appear on Sept. 10.
TEMPERLEY TRANSPORTER COMPANY,
72, Bishopsgate Street Within, London, E.C.
Telephone: 865 London Wall. Telegrams: "Transumo."

AMMONIACAL Liquor wanted.
Brotherton and Co., Ltd., Ammonia Distillers. Works: Birmingham, Glasgow, Leeds, Liverpool, Wakefield, and Sunderland.

"NUGEPE" GAS PLANT CEMENT.
JOHN E. WILLIAMS AND CO.,
LOWER MOSS LANE,
MANCHESTER, S.W.
For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

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Brotherton and Co., Ltd., Tar Distillers. Works: Birmingham, Glasgow, Leeds, Liverpool, Wakefield, and Sunderland.

PATENTS AND TRADE MARKS
PUBLICATIONS, "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

BROTHERTON & CO., LIMITED.
Offices: Commercial Buildings, Leeds. Correspondence invited.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 Years. References given to Gas Companies.

BENZOL
AND
CARBURINE FOR GAS ENRICHING.
ALSO
THE MAXIM PATENT CARBURETTOR.
For Prices, &c., apply to
THE GAS LIGHTING IMPROVEMENT CO., LTD.,
7, Bishopsgate Street Without,
LONDON, E.C.
Telegraphic Address: "Carburine, London."

GAZINE—A radical Solvent and Preventative of Naphthalene deposits, and the Automatic cleaning of Mains and Services.
It is also used for the Enrichment of Gas, and has an illuminating value double that of 90 per cent. Benzol.
Supplied by C. Bourne, West Moor Chemical Works, Killingworth, or through his Agent, F. J. Nicol, Pilgrim Street Chambers, Newcastle-on-Tyne.
Telegrams: "Doric," Newcastle-on-Tyne. National Telephone No. 2497.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. Blakeley, Gas Engineer, Thornhill, Dewsbury.

BRISTOL RECORDING GAUGES AND THERMOMETERS.
J. W. & C. J. PHILLIPS, 23, College Hill, London, E.C., and 7, Park Square, Leeds.

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market,
Can be Exchanged for Spent Oxide.
Read Holliday and Sons, Ltd., Huddersfield.

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SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness, with efficiency for Repairs.
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STEAM (all Types, all Sizes) Boilers.
Vertical, Loco., Cornish, Launch, Field-tube; also AIR RECEIVERS, FEED-WATER HEATERS, CYLINDERS, &c.
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THE UNIVERSITY OF LEEDS.
DEPARTMENT OF FUEL AND GAS ENGINEERING.
THE New Building of the above Department WILL BE OPEN for the reception of Students on Oct. 1, 1907.
For Particulars respecting Degree and Diploma Courses in Gas Engineering, see Special Prospectus to be obtained on Application to the Registrar.

GENTLEMAN with a large Connection among Gas and Water Companies and Lighting Authorities desires to REPRESENT good firm. Whole or part services.
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SULPHATE of Ammonia Plant (Repairs, &c.), Lead Tanks, Saturators, Injectors made, Fixed, or Repaired by a First-Class LEAD-BURNER of great experience. Own machine Tools, &c. Special Attention to Small Repairs. Write for list of Jobs done. Formerly with Dempster, Cockey, Walker, and others.
John Jay, 124, Warwick Road, Kensington.

WORKING Manager, with many Years' Practical Experience in Gas Manufacture, requires SITUATION. Good Carbonizer. Well up in Main and Service Laying, Slot Meter Installations, and General Routine. Good Testimonials.
Address No. 4832, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

CONSULTING Engineer and Patentee, Specialist in Gas Plant, with City Offices (in Midlands), is open to admit into PARTNERSHIP young Gas Engineer or Draughtsman. Capital required about £500 for half share, including Patents, which turn in large profits. First-Class opening for suitable Man. References given and required.
Address No. 4831, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, a Working Manager for a small Gas-Works in Mid-Wales.
Applicants should state Age, Wages required, and enclose *copies* of Two recent Testimonials to No. 4816, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

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WANTED, a thoroughly good Commercial Man, with about £2500 Capital, who is capable of DIRECTING or MANAGING a Gas Engineers' Business. Salary up to £300 a Year to commence with. Profit on investment, 20 per cent. Every opportunity for investigation. Highest References required and given. Sole reason for desired Partnership, shortness of Capital and Owners' time.
Principals only apply to No. 4817, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

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WANTED, an Engineer for a Gas-Works with an Annual make of about 355 Million cubic feet. Must have thorough Knowledge of, and Experience in, Construction of Works, and in the Manufacture, Distribution, and Analysis of Gas. Must be Qualified in the use of Electrically-driven Machinery, and in the Distribution of Electricity. Salary not less than £600 per Annum, with free House, Light, and Fuel. Passage Paid. Three Years' Agreement.
None but well Educated, fully Qualified, Experienced Men need Apply.
State Experience, Age, whether Married, present Salary, and Salary required.
Applications, on or before Sept. 17, to No. 4825, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

HEYWOOD CORPORATION GAS-WORKS.
MAN and Wife required for Show Room.
Man must be smart CANVASSER, able to Advise Consumers, Experienced in the Maintenance of Incandescent Burners, and the Sale of Gas-Stoves and Gas-Fittings. House, Rates, Gas and Water Free.
Applications stating Experience and Wages required, to be forwarded to the Gas Manager, Heywood, not later than Tuesday, Sept. 17, 1907.

WELL-KNOWN Firm of Gas-Cooker Makers require immediately a Smart GAS-FITTER for Slot Installations.
Reply, stating Age, Experience, Wages required, and enclosing *copies* of References to No. 4830, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, immediately, in South Yorkshire, an Experienced SULPHATE MAKER, Wages, 5s. 6d. per Shift.
Apply, stating Age, Experience, and enclosing *copies* of References, to No. 4828, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, for Gas-Works in the Midlands, a Good GENERAL FITTER, used to Coal-Elevating Machinery, with Inclines, Gas-Engines, Deep-Well Pumps, &c. Only First-Class Men need apply. A splendid opening for an Energetic and Industrious Man.
Apply, stating Age, Wages required, &c., enclosing *copies* of References to No. 4829, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

GAS-Lamps: Two "Edgar" Eclipse Outdoor 4-Light; Two 4-Light Indoor; One "King" arc 2-Light; Two "Sugg's" Stafford 2-Light One 2-Light Wimbledon. All new. 40 per cent. off list to clear.
Address No. 4826, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

PATENT for Sale, Intensified Gas-Lamp (Upright), Hundreds sold; also Registered Design of Lamp. Very successful. No time to develop.
Address No. 4827, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

GASMEISTER.
33 Jahre alt (Deutscher) seit 1897 im Gasfah tätig Ofenbauer vom Beruf der schon Betribsleiter war und gute Erfahrungen im Betrib so wie Retortenofenbau hat sucht anders wo Stellung, ganz gleich wo.
Offerten sendet man an Reschotzkowski, Stettin, Deutschland, Otto Strasse, 6.

GAS BOOKS WANTED.
MY Library of Gas Books, and Subjects akin thereto, and which I believe was the most complete in existence, was destroyed in the April 18, 1906, San Francisco disaster. In RE-ESTABLISHING this Library—which will find an ultimate home with a Gas Association or Educational Institution—I am desirous of securing all available Gas Literature printed in the English language, including Technical Works, Reports, Pamphlets, &c., and will PURCHASE such as I do not yet possess. Those having such works will accommodate me by sending a description thereof, stating Condition of Volume and net Price desired, Carriage included.
L. P. Lowe.
1214, Polk Street,
San Francisco, Cal., U.S.A.

PLYMOUTH CORPORATION WATER-WORKS
CAST-IRON PIPES.
TENDERS are invited for the Supply and Delivery of about 1500 Tons of 24-inch, 20-inch, and 18-inch CAST-IRON PIPES AND SPECIAL CASTINGS.
Specification, form of Tender, and other Information, may be obtained at this Office, from the undersigned, on and after Thursday, the 5th of September, 1907, on payment of the sum of £3 3s., which will be returned on receipt of a *bonâ-fide* Tender.
The lowest or any Tender will not necessarily be accepted.
Sealed Tenders, endorsed "Cast-Iron Pipes," addressed to the Chairman of the Water Committee, Municipal Buildings, Plymouth, to be delivered at this Office by 12 o'clock Noon on Thursday, the 19th of September, 1907.
Frank Howarth, M.Inst.C.E.,
Water Engineer.
Municipal Buildings,
Plymouth, Aug. 30, 1907.

PLYMOUTH CORPORATION WATER-WORKS.
SLUICE VALVES, &c.
TENDERS are invited for the Supply and Delivery of 25-inch, 24-inch, 20-inch, 18-inch, and 12-inch SLUICE VALVES, also 4-inch DOUBLE AIR-VALVES, WITH STRONG ROAD SURFACE BOXES.
Specification, Form of Tender, and other Information, may be obtained at this Office, from the undersigned, on and after Thursday, the 5th of September, 1907.
The lowest or any Tender will not necessarily be accepted.
Sealed Tenders, endorsed "Sluice Valves, &c.," addressed to the Chairman of the Water Committee, Municipal Buildings, Plymouth, to be delivered at this Office, by 12 o'clock Noon on Thursday, the 19th of September, 1907.
Frank Howarth, M.Inst.C.E.,
Water Engineer.
Municipal Buildings,
Plymouth, Aug. 30, 1907.

LEIGH-ON-SEA URBAN DISTRICT COUNCIL.
(Gas Department.)
THE above Council invite Tenders for the Purchase of not less than Eighty Chaldrons of COKE per Month, during the next Eight Months, *ex* their Gas-Works, Leigh-on-Sea.
Tenders, endorsed "Tender for Coke," and stating Price offered per Chaldron, must be delivered to the undersigned not later than Tuesday, the 17th day of September inst.
The Council do not bind themselves to accept any Tender.
W. Carlyle Croasdell,
Clerk to the Council.
Council Offices, Leigh-on-Sea,
Sept. 2, 1907.